

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station cm	As Top Combo	As Top cm ²	As Bottom cm ²	At Shear cm ² /cm	At Torsion cm ²	At Torsion cm ² /cm
N+3.75	B178	224	V50x90	338	B.2.4.5-3	3.42	5.37	0.05	0.00	0.00
N+3.75	B178	224	V50x90	388	B.2.4.5-3	3.42	5.65	0.05	0.00	0.00
N+3.75	B178	224	V50x90	388	B.2.4.5-3	3.73	5.90	0.04	0.00	0.00
N+3.75	B178	224	V50x90	438	B.2.4.5-3	3.73	5.32	0.05	0.00	0.00
N+3.75	B178	224	V50x90	488	B.2.4.5-3	3.73	4.55	0.05	0.00	0.00
N+3.75	B178	224	V50x90	538	B.2.4.5-3	3.73	3.82	0.05	0.00	0.00
N+3.75	B178	224	V50x90	538	B.2.4.5-3	3.84	4.02	0.06	0.00	0.00
N+3.75	B178	224	V50x90	588	B.2.4.5-3	3.84	3.84	0.06	0.00	0.00
N+3.75	B178	224	V50x90	638	B.2.4.5-3	3.96	3.84	0.06	0.00	0.00
N+3.75	B178	224	V50x90	688	B.2.4.5-3	6.81	3.84	0.07	0.00	0.00
N+3.75	B178	224	V50x90	688	B.2.4.5-3	6.59	3.65	0.08	18.41	0.08
N+3.75	B178	224	V50x90	719	B.2.4.5-3	9.25	3.65	0.08	18.41	0.08
N+3.75	B178	224	V50x90	750	B.2.4.5-3	12.02	6.30	0.08	18.41	0.08
N+3.75	B230	189	V50x90	25	B.2.4.5-8	11.56	5.72	0.04	24.59	0.10
N+3.75	B230	189	V50x90	56	B.2.4.5-8	8.45	2.84	0.04	24.59	0.10
N+3.75	B230	189	V50x90	88	B.2.4.5-8	5.46	2.84	0.04	24.59	0.10
N+3.75	B230	189	V50x90	88	B.2.4.5-3	6.16	3.59	0.04	0.00	0.00
N+3.75	B230	189	V50x90	138	B.2.4.5-8	3.59	3.59	0.04	0.00	0.00
N+3.75	B230	189	V50x90	188	B.2.4.5-8	3.59	3.59	0.04	0.00	0.00
N+3.75	B230	189	V50x90	238	B.2.4.5-8	3.59	5.40	0.04	0.00	0.00
N+3.75	B230	189	V50x90	238	B.2.4.5-3	4.17	5.97	0.00	0.00	0.00
N+3.75	B230	189	V50x90	288	B.2.4.5-3	4.17	7.21	0.00	0.00	0.00
N+3.75	B230	189	V50x90	338	B.2.4.5-3	4.17	8.20	0.00	0.00	0.00
N+3.75	B230	189	V50x90	388	B.2.4.5-3	4.17	8.94	0.00	0.00	0.00
N+3.75	B230	189	V50x90	388	B.2.4.5-3	4.59	9.06	0.00	0.00	0.00
N+3.75	B230	189	V50x90	438	B.2.4.5-3	4.59	8.44	0.00	0.00	0.00
N+3.75	B230	189	V50x90	488	B.2.4.5-3	4.59	7.58	0.00	0.00	0.00
N+3.75	B230	189	V50x90	538	B.2.4.5-3	4.59	6.72	0.00	0.00	0.00
N+3.75	B230	189	V50x90	538	B.2.4.5-3	4.66	6.73	0.04	0.00	0.00
N+3.75	B230	189	V50x90	588	B.2.4.5-3	4.66	4.81	0.04	0.00	0.00
N+3.75	B230	189	V50x90	638	B.2.4.5-3	4.66	4.66	0.04	0.00	0.00
N+3.75	B230	189	V50x90	688	B.2.4.5-3	6.09	4.66	0.04	0.00	0.00
N+3.75	B230	189	V50x90	688	B.2.4.5-3	5.98	4.41	0.04	24.67	0.10
N+3.75	B230	189	V50x90	719	B.2.4.5-3	8.65	4.41	0.04	24.67	0.10
N+3.75	B230	189	V50x90	750	B.2.4.5-3	11.44	6.44	0.04	24.67	0.10
N+3.75	B231	236	V50x90	50	B.2.4.5-8	19.89	12.49	0.14	0.00	0.00
N+3.75	B231	236	V50x90	89	B.2.4.5-3	14.17	5.75	0.14	0.00	0.00
N+3.75	B231	236	V50x90	128	B.2.4.5-8	8.47	5.75	0.14	0.00	0.00
N+3.75	B231	236	V50x90	128	B.2.4.5-8	8.41	5.56	0.04	0.00	0.00
N+3.75	B231	236	V50x90	178	B.2.4.5-8	5.56	5.56	0.04	0.00	0.00
N+3.75	B231	236	V50x90	228	B.2.4.5-8	5.56	6.63	0.04	0.00	0.00
N+3.75	B231	236	V50x90	278	B.2.4.5-8	5.56	11.15	0.04	0.00	0.00
N+3.75	B231	236	V50x90	278	B.2.4.5-8	5.32	10.96	0.00	0.00	0.00
N+3.75	B231	236	V50x90	328	B.2.4.5-8	5.32	13.45	0.00	0.00	0.00
N+3.75	B231	236	V50x90	378	B.2.4.5-8	5.32	14.17	0.00	0.00	0.00
N+3.75	B231	236	V50x90	428	B.2.4.5-8	5.32	14.17	0.00	0.00	0.00
N+3.75	B231	236	V50x90	428	B.2.4.5-8	5.05	14.17	0.00	0.00	0.00
N+3.75	B231	236	V50x90	471	B.2.4.5-8	5.05	14.17	0.00	0.00	0.00
N+3.75	B231	236	V50x90	513	B.2.4.5-8	5.05	14.24	0.00	0.00	0.00
N+3.75	B231	236	V50x90	556	B.2.4.5-8	5.05	14.58	0.00	0.00	0.00
N+3.75	B231	236	V50x90	556	B.2.4.5-8	4.67	14.47	0.00	0.00	0.00
N+3.75	B231	236	V50x90	595	B.2.4.5-8	4.67	14.17	0.00	0.00	0.00
N+3.75	B231	236	V50x90	634	B.2.4.5-8	4.67	14.17	0.00	0.00	0.00
N+3.75	B231	236	V50x90	673	B.2.4.5-8	4.67	14.17	0.00	0.00	0.00
N+3.75	B231	236	V50x90	673	B.2.4.5-8	4.22	14.17	0.00	0.00	0.00
N+3.75	B231	236	V50x90	722	B.2.4.5-8	4.22	13.31	0.00	0.00	0.00
N+3.75	B231	236	V50x90	771	B.2.4.5-8	4.22	10.49	0.00	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station	As Top Combo	As Top	As Bottom	At Shear	At Torsion	At Torsion
				cm		cm ²	cm ²	cm ² /cm	cm ²	cm ² /cm
N+3.75	B231	236	V50x90	820	B.2.4.5-8	4.22	7.83	0.00	0.00	0.00
N+3.75	B231	236	V50x90	820	B.2.4.5-8	3.49	7.26	0.04	0.00	0.00
N+3.75	B231	236	V50x90	858	B.2.4.5-8	3.49	3.95	0.04	0.00	0.00
N+3.75	B231	236	V50x90	897	B.2.4.5-8	3.49	3.49	0.04	0.00	0.00
N+3.75	B231	236	V50x90	935	B.2.4.5-8	3.49	3.49	0.04	0.00	0.00
N+3.75	B231	236	V50x90	973	B.2.4.5-8	7.07	3.49	0.04	0.00	0.00
N+3.75	B231	236	V50x90	973	B.2.4.5-8	5.99	2.61	0.14	0.00	0.00
N+3.75	B231	236	V50x90	1010	B.2.4.5-8	14.17	2.61	0.15	0.00	0.00
N+3.75	B231	236	V50x90	1046	B.2.4.5-8	17.69	9.33	0.15	0.00	0.00
N+3.75	B232	222	V50x90	25	B.2.4.5-3	13.12	7.05	0.09	0.00	0.00
N+3.75	B232	222	V50x90	67	B.2.4.5-3	9.71	4.06	0.09	0.00	0.00
N+3.75	B232	222	V50x90	108	B.2.4.5-3	6.52	4.06	0.08	0.00	0.00
N+3.75	B232	222	V50x90	150	B.2.4.5-3	4.06	4.06	0.08	0.00	0.00
N+3.75	B232	222	V50x90	150	B.2.4.5-3	5.08	5.08	0.07	0.00	0.00
N+3.75	B232	222	V50x90	200	B.2.4.5-3	5.08	5.08	0.07	0.00	0.00
N+3.75	B232	222	V50x90	249	B.2.4.5-3	5.08	5.08	0.07	0.00	0.00
N+3.75	B232	222	V50x90	299	B.2.4.5-3	5.08	5.92	0.06	0.00	0.00
N+3.75	B232	222	V50x90	299	B.2.4.5-3	5.75	6.48	0.06	0.00	0.00
N+3.75	B232	222	V50x90	349	B.2.4.5-3	5.75	7.30	0.05	0.00	0.00
N+3.75	B232	222	V50x90	399	B.2.4.5-3	5.75	7.94	0.05	0.00	0.00
N+3.75	B232	222	V50x90	449	B.2.4.5-3	5.75	8.33	0.05	0.00	0.00
N+3.75	B232	222	V50x90	449	B.2.4.5-3	6.26	8.69	0.06	0.00	0.00
N+3.75	B232	222	V50x90	492	B.2.4.5-3	6.26	8.31	0.06	0.00	0.00
N+3.75	B232	222	V50x90	536	B.2.4.5-3	6.26	7.75	0.07	0.00	0.00
N+3.75	B232	222	V50x90	579	B.2.4.5-3	6.26	7.02	0.07	0.00	0.00
N+3.75	B232	222	V50x90	579	B.2.4.5-3	6.67	7.35	0.08	0.00	0.00
N+3.75	B232	222	V50x90	619	B.2.4.5-3	7.70	6.67	0.08	0.00	0.00
N+3.75	B232	222	V50x90	659	B.2.4.5-3	10.26	6.99	0.08	0.00	0.00
N+3.75	B235	361	V50x90	0	B.2.4.7-4	0.21	0.30	0.06	0.00	0.00
N+3.75	B235	361	V50x90	39	B.2.4.5-8	2.29	2.29	0.06	0.00	0.00
N+3.75	B235	361	V50x90	79	B.2.4.5-8	2.29	2.29	0.07	0.00	0.00
N+3.75	B235	361	V50x90	118	B.2.4.5-8	2.29	2.29	0.07	0.00	0.00
N+3.75	B235	361	V50x90	157	B.2.4.5-8	2.94	2.29	0.07	0.00	0.00
N+3.75	B235	361	V50x90	157	B.2.4.5-8	3.17	2.52	0.08	0.00	0.00
N+3.75	B235	361	V50x90	201	B.2.4.5-8	4.90	2.52	0.09	0.00	0.00
N+3.75	B235	361	V50x90	245	B.2.4.5-8	6.84	2.52	0.09	0.00	0.00
N+3.75	B235	361	V50x90	289	B.2.4.5-8	8.99	4.66	0.09	0.00	0.00
N+3.75	B237	32	V50x90	50	B.2.4.5-3	10.63	5.73	0.13	0.00	0.00
N+3.75	B237	32	V50x90	84	B.2.4.5-3	7.93	3.52	0.13	0.00	0.00
N+3.75	B237	32	V50x90	117	B.2.4.5-3	5.37	3.31	0.13	0.00	0.00
N+3.75	B237	32	V50x90	151	B.2.4.5-3	3.31	3.31	0.13	0.00	0.00
N+3.75	B237	32	V50x90	151	B.2.4.5-3	4.09	4.09	0.11	0.00	0.00
N+3.75	B237	32	V50x90	189	B.2.4.5-3	4.09	4.09	0.11	0.00	0.00
N+3.75	B237	32	V50x90	227	B.2.4.5-3	4.09	4.09	0.11	0.00	0.00
N+3.75	B237	32	V50x90	264	B.2.4.5-3	4.09	4.89	0.10	0.00	0.00
N+3.75	B237	32	V50x90	302	B.2.4.5-3	4.09	6.41	0.10	0.00	0.00
N+3.75	B237	32	V50x90	302	B.2.4.5-3	4.73	6.96	0.10	0.00	0.00
N+3.75	B237	32	V50x90	336	B.2.4.7-4	4.85	8.00	0.10	0.00	0.00
N+3.75	B237	32	V50x90	369	B.2.4.7-4	6.16	8.94	0.10	0.00	0.00
N+3.75	B237	32	V50x90	403	B.2.4.7-4	7.55	9.77	0.10	0.00	0.00
N+3.75	B238	21	V50x90	25	B.2.4.5-8	4.44	2.13	0.05	0.00	0.00
N+3.75	B238	21	V50x90	71	B.2.4.7-8	2.34	1.92	0.05	0.00	0.00
N+3.75	B238	21	V50x90	117	B.2.4.7-4	1.21	2.48	0.05	0.00	0.00
N+3.75	B238	21	V50x90	117	B.2.4.7-4	1.36	2.59	0.04	0.00	0.00
N+3.75	B238	21	V50x90	166	B.2.4.7-4	1.36	2.94	0.04	0.00	0.00
N+3.75	B238	21	V50x90	215	B.2.4.7-4	1.36	3.25	0.03	0.00	0.00
N+3.75	B238	21	V50x90	264	B.2.4.7-4	1.36	3.83	0.03	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station	As Top Combo	As Top	As Bottom	At Shear	At Torsion	At Torsion
				cm		cm ²	cm ²	cm ² /cm	cm ²	cm ² /cm
N+3.75	B238	21	V50x90	264	B.2.4.7-8	1.52	3.84	0.03	0.00	0.00
N+3.75	B238	21	V50x90	302	B.2.4.7-8	1.52	4.05	0.03	0.00	0.00
N+3.75	B238	21	V50x90	341	B.2.4.7-8	1.52	4.24	0.03	0.00	0.00
N+3.75	B238	21	V50x90	379	B.2.4.7-8	1.52	4.34	0.04	0.00	0.00
N+3.75	B238	21	V50x90	417	B.2.4.7-8	1.56	4.32	0.04	0.00	0.00
N+3.75	B238	21	V50x90	417	B.2.4.7-8	1.89	4.55	0.04	0.00	0.00
N+3.75	B238	21	V50x90	466	B.2.4.7-8	3.47	4.14	0.04	0.00	0.00
N+3.75	B238	21	V50x90	515	B.2.4.5-8	5.38	4.04	0.05	0.00	0.00
N+3.75	B240	4482	V50x90	50	B.2.4.5-8	13.06	9.71	0.16	0.00	0.00
N+3.75	B240	4482	V50x90	84	B.2.4.7-8	8.51	8.99	0.15	0.00	0.00
N+3.75	B240	4482	V50x90	117	B.2.4.7-8	5.04	9.03	0.15	0.00	0.00
N+3.75	B240	4482	V50x90	117	B.2.4.7-8	5.24	8.94	0.11	0.00	0.00
N+3.75	B240	4482	V50x90	166	B.2.4.5-8	4.19	8.28	0.11	0.00	0.00
N+3.75	B240	4482	V50x90	215	B.2.4.5-8	4.19	7.40	0.10	0.00	0.00
N+3.75	B240	4482	V50x90	264	B.2.4.5-8	4.19	6.35	0.10	0.00	0.00
N+3.75	B240	4482	V50x90	264	B.2.4.5-8	4.33	6.53	0.11	0.00	0.00
N+3.75	B240	4482	V50x90	302	B.2.4.5-8	4.33	6.24	0.11	0.00	0.00
N+3.75	B240	4482	V50x90	341	B.2.4.5-8	4.33	6.59	0.11	0.00	0.00
N+3.75	B240	4482	V50x90	379	B.2.4.5-8	4.33	6.79	0.12	0.00	0.00
N+3.75	B240	4482	V50x90	417	B.2.4.7-8	5.80	6.88	0.12	0.00	0.00
N+3.75	B240	4482	V50x90	417	B.2.4.7-8	6.23	7.20	0.16	0.00	0.00
N+3.75	B240	4482	V50x90	454	B.2.4.5-8	10.22	7.35	0.17	0.00	0.00
N+3.75	B240	4482	V50x90	490	B.2.4.7-8	14.17	8.24	0.17	0.00	0.00
N+3.75	B257	3503	V50x90	25	B.2.4.5-8	9.00	4.49	0.08	0.00	0.00
N+3.75	B257	3503	V50x90	71	B.2.4.7-8	4.38	4.63	0.08	0.00	0.00
N+3.75	B257	3503	V50x90	117	B.2.4.5-8	2.25	6.04	0.07	0.00	0.00
N+3.75	B257	3503	V50x90	117	B.2.4.5-8	2.12	5.85	0.06	0.00	0.00
N+3.75	B257	3503	V50x90	166	B.2.4.5-8	2.12	6.27	0.05	0.00	0.00
N+3.75	B257	3503	V50x90	215	B.2.4.5-8	2.12	6.49	0.05	0.00	0.00
N+3.75	B257	3503	V50x90	264	B.2.4.5-8	2.12	6.99	0.05	0.00	0.00
N+3.75	B257	3503	V50x90	264	B.2.4.5-8	2.03	6.69	0.05	0.00	0.00
N+3.75	B257	3503	V50x90	302	B.2.4.5-8	2.03	5.99	0.05	0.00	0.00
N+3.75	B257	3503	V50x90	341	B.2.4.5-8	2.03	5.61	0.05	0.00	0.00
N+3.75	B257	3503	V50x90	379	B.2.4.5-8	2.03	5.20	0.06	0.00	0.00
N+3.75	B257	3503	V50x90	417	B.2.4.5-8	2.03	4.70	0.06	0.00	0.00
N+3.75	B257	3503	V50x90	417	B.2.4.7-8	2.04	4.63	0.08	0.00	0.00
N+3.75	B257	3503	V50x90	466	B.2.4.7-8	3.69	2.75	0.08	0.00	0.00
N+3.75	B257	3503	V50x90	515	B.2.4.5-8	8.09	3.88	0.08	0.00	0.00
N+3.75	B258	7	V30x90	0	B.2.4.5-8	2.34	1.25	0.02	0.00	0.00
N+3.75	B258	7	V30x90	39	B.2.4.5-8	1.86	0.71	0.01	0.00	0.00
N+3.75	B258	7	V30x90	78	B.2.4.5-8	1.49	0.71	0.01	0.00	0.00
N+3.75	B258	7	V30x90	117	B.2.4.5-8	1.23	0.71	0.01	0.00	0.00
N+3.75	B258	7	V30x90	117	B.2.4.5-8	1.19	0.73	0.02	0.00	0.00
N+3.75	B258	7	V30x90	166	B.2.4.5-8	0.73	0.73	0.01	0.00	0.00
N+3.75	B258	7	V30x90	215	B.2.4.5-8	0.73	0.74	0.01	0.00	0.00
N+3.75	B258	7	V30x90	264	B.2.4.5-8	0.73	0.82	0.01	0.00	0.00
N+3.75	B258	7	V30x90	264	B.2.4.5-8	0.68	0.75	0.01	0.00	0.00
N+3.75	B258	7	V30x90	302	B.2.4.5-8	0.68	0.91	0.01	0.00	0.00
N+3.75	B258	7	V30x90	341	B.2.4.5-8	0.68	1.01	0.01	0.00	0.00
N+3.75	B258	7	V30x90	379	B.2.4.5-8	0.68	1.05	0.01	0.00	0.00
N+3.75	B258	7	V30x90	417	B.2.4.5-8	0.68	1.02	0.01	0.00	0.00
N+3.75	B258	7	V30x90	417	B.2.4.5-8	0.66	0.97	0.01	0.00	0.00
N+3.75	B258	7	V30x90	458	B.2.4.5-8	0.66	0.98	0.01	0.00	0.00
N+3.75	B258	7	V30x90	499	B.2.4.5-8	0.66	0.87	0.01	0.00	0.00
N+3.75	B258	7	V30x90	540	B.2.4.7-8	0.55	0.64	0.01	0.00	0.00
N+0.00	B5	11	V40x90	0	B.2.4.5-3	3.68	3.51	0.06	0.00	0.00
N+0.00	B5	11	V40x90	37	B.2.4.5-3	5.97	5.97	0.06	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station	As Top Combo	As Top	As Bottom	At Shear	At Torsion	At Torsion
				cm		cm ²	cm ²	cm ² /cm	cm ²	cm ² /cm
N+0.00	B5	11	V40x90	74	B.2.4.5-3	5.97	5.97	0.06	0.00	0.00
N+0.00	B5	11	V40x90	111	B.2.4.5-3	5.97	5.97	0.06	0.00	0.00
N+0.00	B5	11	V40x90	111	B.2.4.5-3	6.02	6.02	0.06	0.00	0.00
N+0.00	B5	11	V40x90	150	B.2.4.5-3	6.02	6.02	0.06	0.00	0.00
N+0.00	B5	11	V40x90	189	B.2.4.5-3	6.02	6.02	0.06	0.00	0.00
N+0.00	B5	11	V40x90	227	B.2.4.5-3	6.02	6.02	0.06	0.00	0.00
N+0.00	B5	11	V40x90	266	B.2.4.5-3	6.02	6.02	0.06	0.00	0.00
N+0.00	B5	11	V40x90	266	B.2.4.5-8	11.81	11.20	0.13	0.00	0.00
N+0.00	B5	11	V40x90	305	B.2.4.5-8	11.20	7.83	0.13	0.00	0.00
N+0.00	B5	11	V40x90	343	B.2.4.5-8	7.61	3.55	0.14	0.00	0.00
N+0.00	B5	11	V40x90	382	B.2.4.5-3	6.23	2.93	0.14	0.00	0.00
N+0.00	B5	11	V40x90	420	B.2.4.5-3	10.68	5.49	0.14	0.00	0.00
N+0.00	B6	2962	V40x90	0	B.2.4.5-3	11.20	5.82	0.11	0.00	0.00
N+0.00	B6	2962	V40x90	50	B.2.4.5-3	7.40	3.17	0.11	0.00	0.00
N+0.00	B6	2962	V40x90	100	B.2.4.5-3	3.85	3.17	0.11	0.00	0.00
N+0.00	B6	2962	V40x90	150	B.2.4.5-3	3.17	3.17	0.10	0.00	0.00
N+0.00	B6	2962	V40x90	150	B.2.4.5-3	2.99	2.99	0.08	0.00	0.00
N+0.00	B6	2962	V40x90	200	B.2.4.5-3	2.99	2.99	0.07	0.00	0.00
N+0.00	B6	2962	V40x90	250	B.2.4.5-3	2.99	3.63	0.07	0.00	0.00
N+0.00	B6	2962	V40x90	300	B.2.4.5-3	2.99	4.38	0.07	0.00	0.00
N+0.00	B6	2962	V40x90	300	B.2.4.5-3	2.73	4.09	0.09	0.00	0.00
N+0.00	B6	2962	V40x90	349	B.2.4.7-8	3.40	4.36	0.09	0.00	0.00
N+0.00	B6	2962	V40x90	397	B.2.4.5-8	6.16	5.06	0.10	0.00	0.00
N+0.00	B9	3303	V40x90	0	B.2.4.5-8	12.57	9.74	0.13	0.00	0.00
N+0.00	B9	3303	V40x90	50	B.2.4.5-8	11.20	6.29	0.13	0.00	0.00
N+0.00	B9	3303	V40x90	100	B.2.4.5-8	7.97	6.29	0.12	0.00	0.00
N+0.00	B9	3303	V40x90	150	B.2.4.5-8	6.29	6.29	0.12	0.00	0.00
N+0.00	B9	3303	V40x90	150	B.2.4.5-8	5.14	5.14	0.09	0.00	0.00
N+0.00	B9	3303	V40x90	200	B.2.4.5-8	5.14	5.14	0.09	0.00	0.00
N+0.00	B9	3303	V40x90	250	B.2.4.5-8	5.14	5.14	0.08	0.00	0.00
N+0.00	B9	3303	V40x90	300	B.2.4.5-8	5.14	5.14	0.08	0.00	0.00
N+0.00	B9	3303	V40x90	300	B.2.4.5-8	4.22	4.22	0.10	0.00	0.00
N+0.00	B9	3303	V40x90	349	B.2.4.7-8	4.25	5.20	0.10	0.00	0.00
N+0.00	B9	3303	V40x90	397	B.2.4.5-8	7.31	6.60	0.10	0.00	0.00
N+0.00	B10	16	V40x90	0	B.2.4.5-3	10.98	6.60	0.11	0.00	0.00
N+0.00	B10	16	V40x90	42	B.2.4.5-3	8.36	4.44	0.10	0.00	0.00
N+0.00	B10	16	V40x90	84	B.2.4.5-3	6.11	4.44	0.10	0.00	0.00
N+0.00	B10	16	V40x90	84	B.2.4.5-3	6.30	6.19	0.07	0.00	0.00
N+0.00	B10	16	V40x90	111	B.2.4.5-3	6.20	6.19	0.07	0.00	0.00
N+0.00	B10	16	V40x90	111	B.2.4.5-3	6.12	6.12	0.07	0.00	0.00
N+0.00	B10	16	V40x90	140	B.2.4.5-3	6.12	6.12	0.07	0.00	0.00
N+0.00	B10	16	V40x90	168	B.2.4.5-3	6.12	6.12	0.07	0.00	0.00
N+0.00	B10	16	V40x90	168	B.2.4.5-3	7.11	7.11	0.07	0.00	0.00
N+0.00	B10	16	V40x90	210	B.2.4.5-3	7.11	7.11	0.07	0.00	0.00
N+0.00	B10	16	V40x90	252	B.2.4.5-3	7.11	7.11	0.07	0.00	0.00
N+0.00	B10	16	V40x90	252	B.2.4.5-3	7.12	7.12	0.07	0.00	0.00
N+0.00	B10	16	V40x90	266	B.2.4.5-3	7.12	7.12	0.07	0.00	0.00
N+0.00	B10	16	V40x90	266	B.2.4.5-3	6.87	6.87	0.07	0.00	0.00
N+0.00	B10	16	V40x90	301	B.2.4.5-3	6.87	6.87	0.08	0.00	0.00
N+0.00	B10	16	V40x90	336	B.2.4.5-3	6.87	6.87	0.08	0.00	0.00
N+0.00	B10	16	V40x90	336	B.2.4.5-8	7.91	6.27	0.07	0.00	0.00
N+0.00	B10	16	V40x90	378	B.2.4.5-3	8.53	6.27	0.08	0.00	0.00
N+0.00	B10	16	V40x90	420	B.2.4.5-3	9.66	6.87	0.08	0.00	0.00
N+0.00	B11	2967	V40x90	63	B.2.4.7-8	5.20	2.00	0.00	0.00	0.00
N+0.00	B11	2967	V40x90	95	B.2.4.7-8	3.76	2.35	0.00	0.00	0.00
N+0.00	B11	2967	V40x90	95	B.2.4.7-8	4.31	3.12	0.00	0.00	0.00
N+0.00	B11	2967	V40x90	145	B.2.4.5-8	3.12	3.12	0.00	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station cm	As Top Combo	As Top cm ²	As Bottom cm ²	At Shear cm ² /cm	At Torsion cm ²	At Torsion cm ² /cm
N+0.00	B11	2967	V40x90	195	B.2.4.5-8	3.12	3.22	0.00	0.00	0.00
N+0.00	B11	2967	V40x90	245	B.2.4.5-8	3.12	3.81	0.00	0.00	0.00
N+0.00	B11	2967	V40x90	245	B.2.4.5-8	3.82	4.53	0.00	0.00	0.00
N+0.00	B11	2967	V40x90	295	B.2.4.5-8	3.82	4.64	0.00	0.00	0.00
N+0.00	B11	2967	V40x90	345	B.2.4.5-8	3.82	4.55	0.00	0.00	0.00
N+0.00	B11	2967	V40x90	395	B.2.4.5-8	3.82	4.61	0.00	0.00	0.00
N+0.00	B11	2967	V40x90	395	B.2.4.5-8	4.27	5.09	0.00	0.00	0.00
N+0.00	B11	2967	V40x90	443	B.2.4.5-8	4.27	5.46	0.00	0.00	0.00
N+0.00	B11	2967	V40x90	490	B.2.4.5-8	4.27	5.68	0.00	0.00	0.00
N+0.00	B11	2967	V40x90	490	B.2.4.5-8	4.82	7.08	0.02	0.00	0.00
N+0.00	B11	2967	V40x90	529	B.2.4.5-8	4.82	5.55	0.02	0.00	0.00
N+0.00	B11	2967	V40x90	567	B.2.4.5-8	4.82	4.82	0.03	0.00	0.00
N+0.00	B11	2967	V40x90	606	B.2.4.7-8	6.35	4.82	0.03	0.00	0.00
N+0.00	B11	2967	V40x90	645	B.2.4.5-8	9.96	4.82	0.03	0.00	0.00
N+0.00	B11	2967	V40x90	645	B.2.4.5-8	10.43	5.65	0.18	15.74	0.07
N+0.00	B11	2967	V40x90	688	B.2.4.5-8	15.86	10.60	0.18	15.74	0.07
N+0.00	B13	2170	V50x90	25	B.2.4.5-3	14.17	7.43	0.05	0.00	0.00
N+0.00	B13	2170	V50x90	67	B.2.4.5-3	9.61	4.00	0.04	0.00	0.00
N+0.00	B13	2170	V50x90	108	B.2.4.5-3	5.09	4.00	0.04	0.00	0.00
N+0.00	B13	2170	V50x90	150	B.2.4.5-3	4.00	4.29	0.04	0.00	0.00
N+0.00	B13	2170	V50x90	150	B.2.4.5-3	4.08	4.17	0.04	0.00	0.00
N+0.00	B13	2170	V50x90	200	B.2.4.5-3	4.08	6.46	0.04	0.00	0.00
N+0.00	B13	2170	V50x90	249	B.2.4.5-3	4.08	8.52	0.04	0.00	0.00
N+0.00	B13	2170	V50x90	299	B.2.4.5-3	4.08	10.34	0.04	0.00	0.00
N+0.00	B13	2170	V50x90	299	B.2.4.5-3	4.21	10.31	0.04	0.00	0.00
N+0.00	B13	2170	V50x90	349	B.2.4.5-3	4.21	10.31	0.04	0.00	0.00
N+0.00	B13	2170	V50x90	399	B.2.4.5-3	4.21	10.06	0.04	0.00	0.00
N+0.00	B13	2170	V50x90	449	B.2.4.5-3	4.21	9.55	0.04	0.00	0.00
N+0.00	B13	2170	V50x90	449	B.2.4.5-3	4.39	9.61	0.04	0.00	0.00
N+0.00	B13	2170	V50x90	492	B.2.4.5-3	4.39	7.42	0.04	0.00	0.00
N+0.00	B13	2170	V50x90	536	B.2.4.5-3	4.39	5.06	0.04	0.00	0.00
N+0.00	B13	2170	V50x90	579	B.2.4.5-3	4.39	4.39	0.04	0.00	0.00
N+0.00	B13	2170	V50x90	579	B.2.4.5-3	4.64	4.64	0.05	0.00	0.00
N+0.00	B13	2170	V50x90	619	B.2.4.5-3	8.16	4.64	0.05	0.00	0.00
N+0.00	B13	2170	V50x90	659	B.2.4.5-3	13.76	7.45	0.06	0.00	0.00
N+0.00	B14	22	V50x90	25	B.2.4.4-4	14.17	8.58	0.07	17.76	0.07
N+0.00	B14	22	V50x90	56	B.2.4.5-3	12.16	4.44	0.06	17.76	0.07
N+0.00	B14	22	V50x90	88	B.2.4.5-3	7.51	4.44	0.06	17.76	0.07
N+0.00	B14	22	V50x90	88	B.2.4.5-3	7.63	4.45	0.04	0.00	0.00
N+0.00	B14	22	V50x90	138	B.2.4.5-3	4.45	4.45	0.04	0.00	0.00
N+0.00	B14	22	V50x90	188	B.2.4.5-3	4.45	4.45	0.04	0.00	0.00
N+0.00	B14	22	V50x90	238	B.2.4.5-3	4.45	6.44	0.04	0.00	0.00
N+0.00	B14	22	V50x90	238	B.2.4.5-3	4.50	6.41	0.00	0.00	0.00
N+0.00	B14	22	V50x90	288	B.2.4.5-3	4.50	7.61	0.00	0.00	0.00
N+0.00	B14	22	V50x90	338	B.2.4.5-3	4.50	8.55	0.00	0.00	0.00
N+0.00	B14	22	V50x90	388	B.2.4.5-3	4.50	9.24	0.00	0.00	0.00
N+0.00	B14	22	V50x90	388	B.2.4.5-3	4.59	9.31	0.00	0.00	0.00
N+0.00	B14	22	V50x90	438	B.2.4.5-3	4.59	8.54	0.00	0.00	0.00
N+0.00	B14	22	V50x90	488	B.2.4.5-3	4.59	7.52	0.00	0.00	0.00
N+0.00	B14	22	V50x90	538	B.2.4.5-3	4.59	6.26	0.00	0.00	0.00
N+0.00	B14	22	V50x90	538	B.2.4.5-3	4.68	6.38	0.04	0.00	0.00
N+0.00	B14	22	V50x90	588	B.2.4.5-3	4.68	4.68	0.04	0.00	0.00
N+0.00	B14	22	V50x90	638	B.2.4.5-3	4.68	4.68	0.04	0.00	0.00
N+0.00	B14	22	V50x90	688	B.2.4.5-3	5.31	4.68	0.04	0.00	0.00
N+0.00	B14	22	V50x90	688	B.2.4.5-3	5.29	4.78	0.05	16.72	0.07
N+0.00	B14	22	V50x90	719	B.2.4.5-3	9.69	4.78	0.06	16.72	0.07
N+0.00	B14	22	V50x90	750	B.2.4.5-3	14.17	7.40	0.06	16.72	0.07

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station	As Top Combo	As Top	As Bottom	At Shear	At Torsion	At Torsion
				cm		cm ²	cm ²	cm ² /cm	cm ²	cm ² /cm
N+0.00	B15	2175	V50x90	25	B.2.4.5-3	7.17	3.21	0.04	0.00	0.00
N+0.00	B15	2175	V50x90	56	B.2.4.5-3	3.56	3.56	0.04	0.00	0.00
N+0.00	B15	2175	V50x90	88	B.2.4.5-3	3.56	3.56	0.04	0.00	0.00
N+0.00	B15	2175	V50x90	88	B.2.4.5-3	3.76	3.76	0.00	0.00	0.00
N+0.00	B15	2175	V50x90	138	B.2.4.5-3	3.76	3.98	0.00	0.00	0.00
N+0.00	B15	2175	V50x90	188	B.2.4.5-3	3.76	6.43	0.00	0.00	0.00
N+0.00	B15	2175	V50x90	238	B.2.4.5-3	3.76	8.90	0.00	0.00	0.00
N+0.00	B15	2175	V50x90	238	B.2.4.5-3	3.99	9.22	0.04	0.00	0.00
N+0.00	B15	2175	V50x90	288	B.2.4.5-3	3.99	9.86	0.04	0.00	0.00
N+0.00	B15	2175	V50x90	338	B.2.4.5-3	3.99	10.23	0.04	0.00	0.00
N+0.00	B15	2175	V50x90	388	B.2.4.5-3	3.99	10.35	0.04	0.00	0.00
N+0.00	B15	2175	V50x90	388	B.2.4.5-3	4.18	10.63	0.04	0.00	0.00
N+0.00	B15	2175	V50x90	438	B.2.4.5-3	4.18	9.22	0.04	0.00	0.00
N+0.00	B15	2175	V50x90	488	B.2.4.5-3	4.18	7.61	0.04	0.00	0.00
N+0.00	B15	2175	V50x90	538	B.2.4.5-3	4.18	6.04	0.04	0.00	0.00
N+0.00	B15	2175	V50x90	538	B.2.4.5-3	4.35	6.30	0.00	0.00	0.00
N+0.00	B15	2175	V50x90	588	B.2.4.5-3	4.35	4.35	0.00	0.00	0.00
N+0.00	B15	2175	V50x90	638	B.2.4.5-3	4.35	4.35	0.00	0.00	0.00
N+0.00	B15	2175	V50x90	688	B.2.4.5-3	7.75	4.35	0.01	0.00	0.00
N+0.00	B15	2175	V50x90	688	B.2.4.5-3	7.78	4.48	0.07	0.00	0.00
N+0.00	B15	2175	V50x90	719	B.2.4.5-3	12.58	4.48	0.07	0.00	0.00
N+0.00	B15	2175	V50x90	750	B.2.4.4-4	14.17	8.78	0.07	0.00	0.00
N+0.00	B18	1512	V40x90	0	B.2.4.5-3	11.20	7.99	0.06	0.00	0.00
N+0.00	B18	1512	V40x90	44	B.2.4.5-8	10.32	5.35	0.06	0.00	0.00
N+0.00	B18	1512	V40x90	88	B.2.4.5-8	7.44	5.35	0.06	0.00	0.00
N+0.00	B18	1512	V40x90	88	B.2.4.5-8	5.32	5.32	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	97	B.2.4.5-8	5.32	5.32	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	97	B.2.4.5-8	6.20	6.20	0.05	0.00	0.00
N+0.00	B18	1512	V40x90	145	B.2.4.5-8	6.20	6.20	0.05	0.00	0.00
N+0.00	B18	1512	V40x90	194	B.2.4.5-8	6.20	6.20	0.05	0.00	0.00
N+0.00	B18	1512	V40x90	194	B.2.4.5-8	6.33	6.33	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	238	B.2.4.5-8	6.33	6.33	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	238	B.2.4.5-8	6.24	6.24	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	264	B.2.4.5-8	6.24	6.24	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	291	B.2.4.5-8	6.24	6.24	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	291	B.2.4.5-8	6.13	6.13	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	339	B.2.4.5-8	6.13	6.13	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	388	B.2.4.5-8	6.13	6.13	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	388	B.2.4.5-8	6.28	6.28	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	436	B.2.4.5-8	6.28	6.28	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	484	B.2.4.5-8	6.28	6.28	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	484	B.2.4.5-8	6.42	6.42	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	511	B.2.4.5-8	6.42	6.42	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	538	B.2.4.5-8	6.42	6.42	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	538	B.2.4.5-8	6.53	6.53	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	581	B.2.4.5-8	6.53	6.53	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	581	B.2.4.5-3	6.43	6.43	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	630	B.2.4.5-3	6.43	6.43	0.05	0.00	0.00
N+0.00	B18	1512	V40x90	678	B.2.4.5-3	6.43	6.43	0.05	0.00	0.00
N+0.00	B18	1512	V40x90	678	B.2.4.5-3	5.32	5.32	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	688	B.2.4.5-3	5.32	5.32	0.04	0.00	0.00
N+0.00	B18	1512	V40x90	688	B.2.4.5-3	8.64	5.40	0.06	0.00	0.00
N+0.00	B18	1512	V40x90	731	B.2.4.5-3	10.85	5.40	0.06	0.00	0.00
N+0.00	B18	1512	V40x90	775	B.2.4.5-3	11.20	7.99	0.06	0.00	0.00
N+0.00	B19	34	V40x90	0	B.2.4.5-8	6.70	4.80	0.03	0.00	0.00
N+0.00	B19	34	V40x90	44	B.2.4.5-8	5.73	3.80	0.03	0.00	0.00
N+0.00	B19	34	V40x90	88	B.2.4.5-8	4.84	3.80	0.02	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station cm	As Top Combo	As Top cm ²	As Bottom cm ²	At Shear cm ² /cm	At Torsion cm ²	At Torsion cm ² /cm
N+0.00	B19	34	V40x90	88	B.2.4.5-8	5.45	3.76	0.02	0.00	0.00
N+0.00	B19	34	V40x90	98	B.2.4.5-8	5.46	3.76	0.02	0.00	0.00
N+0.00	B19	34	V40x90	98	B.2.4.5-8	4.97	4.06	0.03	0.00	0.00
N+0.00	B19	34	V40x90	147	B.2.4.5-8	4.09	4.06	0.03	0.00	0.00
N+0.00	B19	34	V40x90	195	B.2.4.5-8	4.21	4.06	0.03	0.00	0.00
N+0.00	B19	34	V40x90	195	B.2.4.5-3	3.96	3.82	0.02	0.00	0.00
N+0.00	B19	34	V40x90	238	B.2.4.5-3	3.83	3.79	0.02	0.00	0.00
N+0.00	B19	34	V40x90	238	B.2.4.5-8	3.62	3.62	0.02	0.00	0.00
N+0.00	B19	34	V40x90	265	B.2.4.5-8	3.62	3.62	0.02	0.00	0.00
N+0.00	B19	34	V40x90	293	B.2.4.5-8	3.62	3.62	0.02	0.00	0.00
N+0.00	B19	34	V40x90	293	B.2.4.5-3	3.37	3.21	0.03	0.00	0.00
N+0.00	B19	34	V40x90	340	B.2.4.5-3	3.21	3.21	0.02	0.00	0.00
N+0.00	B19	34	V40x90	388	B.2.4.5-3	3.21	3.21	0.02	0.00	0.00
N+0.00	B19	34	V40x90	388	B.2.4.5-3	3.76	3.55	0.02	0.00	0.00
N+0.00	B19	34	V40x90	391	B.2.4.5-3	3.76	3.55	0.02	0.00	0.00
N+0.00	B19	34	V40x90	391	B.2.4.5-8	2.83	2.83	0.03	0.00	0.00
N+0.00	B19	34	V40x90	438	B.2.4.5-8	2.83	2.83	0.02	0.00	0.00
N+0.00	B19	34	V40x90	484	B.2.4.5-8	2.83	2.83	0.02	0.00	0.00
N+0.00	B19	34	V40x90	484	B.2.4.5-3	3.08	3.66	0.02	0.00	0.00
N+0.00	B19	34	V40x90	488	B.2.4.5-3	3.08	3.66	0.02	0.00	0.00
N+0.00	B19	34	V40x90	488	B.2.4.5-8	2.94	2.94	0.02	0.00	0.00
N+0.00	B19	34	V40x90	538	B.2.4.5-8	2.94	2.94	0.02	0.00	0.00
N+0.00	B19	34	V40x90	538	B.2.4.5-3	4.59	4.54	0.02	0.00	0.00
N+0.00	B19	34	V40x90	586	B.2.4.5-3	5.03	4.89	0.02	0.00	0.00
N+0.00	B19	34	V40x90	586	B.2.4.5-8	4.89	4.45	0.03	0.00	0.00
N+0.00	B19	34	V40x90	633	B.2.4.5-8	3.76	3.39	0.03	0.00	0.00
N+0.00	B19	34	V40x90	681	B.2.4.5-3	3.54	3.39	0.03	0.00	0.00
N+0.00	B19	34	V40x90	681	B.2.4.5-8	3.21	3.39	0.02	0.00	0.00
N+0.00	B19	34	V40x90	688	B.2.4.5-8	3.21	3.39	0.02	0.00	0.00
N+0.00	B19	34	V40x90	688	B.2.4.5-3	3.49	3.05	0.03	0.00	0.00
N+0.00	B19	34	V40x90	731	B.2.4.5-3	4.36	3.05	0.03	0.00	0.00
N+0.00	B19	34	V40x90	775	B.2.4.5-8	5.54	3.80	0.04	0.00	0.00
N+0.00	B25	118	V50x90	25	B.2.4.7-4	0.28	1.74	0.00	0.00	0.00
N+0.00	B25	118	V50x90	56	B.2.4.7-4	0.42	1.76	0.00	0.00	0.00
N+0.00	B25	118	V50x90	88	B.2.4.7-4	0.42	1.72	0.00	0.00	0.00
N+0.00	B25	118	V50x90	88	B.2.4.7-4	0.42	1.07	0.00	0.00	0.00
N+0.00	B25	118	V50x90	138	B.2.4.7-4	0.41	1.30	0.00	0.00	0.00
N+0.00	B25	118	V50x90	188	B.2.4.7-4	0.41	1.50	0.00	0.00	0.00
N+0.00	B25	118	V50x90	238	B.2.4.7-4	0.41	1.53	0.00	0.00	0.00
N+0.00	B25	118	V50x90	238	B.2.4.7-8	0.27	0.77	0.00	0.00	0.00
N+0.00	B25	118	V50x90	288	B.2.4.7-8	0.27	1.02	0.00	0.00	0.00
N+0.00	B25	118	V50x90	338	B.2.4.7-8	0.27	1.09	0.00	0.00	0.00
N+0.00	B25	118	V50x90	388	B.2.4.7-8	0.27	0.99	0.00	0.00	0.00
N+0.00	B25	118	V50x90	388	B.2.4.7-8	0.23	0.86	0.00	0.00	0.00
N+0.00	B25	118	V50x90	438	B.2.4.7-8	0.23	0.76	0.00	0.00	0.00
N+0.00	B25	118	V50x90	488	B.2.4.7-8	0.23	0.60	0.00	0.00	0.00
N+0.00	B25	118	V50x90	538	B.2.4.7-8	0.28	0.32	0.00	0.00	0.00
N+0.00	B25	118	V50x90	538	B.2.4.7-8	0.30	0.63	0.00	0.00	0.00
N+0.00	B25	118	V50x90	588	B.2.4.7-4	0.38	0.50	0.00	0.00	0.00
N+0.00	B25	118	V50x90	638	B.2.4.7-4	0.67	0.33	0.00	0.00	0.00
N+0.00	B25	118	V50x90	688	B.2.4.5-3	1.21	0.29	0.00	0.00	0.00
N+0.00	B25	118	V50x90	688	B.2.4.7-4	1.16	0.53	0.00	0.00	0.00
N+0.00	B25	118	V50x90	719	B.2.4.7-4	1.19	0.55	0.00	0.00	0.00
N+0.00	B25	118	V50x90	750	B.2.4.5-3	1.28	0.62	0.00	0.00	0.00
N+0.00	B206	2958	V40x90	63	B.2.4.5-8	6.50	5.07	0.04	0.00	0.00
N+0.00	B206	2958	V40x90	95	B.2.4.7-8	4.72	4.90	0.04	0.00	0.00
N+0.00	B206	2958	V40x90	95	B.2.4.7-8	4.71	4.90	0.04	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station	As Top Combo	As Top	As Bottom	At Shear	At Torsion	At Torsion
				cm		cm ²	cm ²	cm ² /cm	cm ²	cm ² /cm
N+0.00	B206	2958	V40x90	145	B.2.4.7-8	2.77	4.56	0.03	0.00	0.00
N+0.00	B206	2958	V40x90	195	B.2.4.7-8	1.45	4.07	0.03	0.00	0.00
N+0.00	B206	2958	V40x90	245	B.2.4.7-8	1.45	3.39	0.03	0.00	0.00
N+0.00	B206	2958	V40x90	245	B.2.4.7-8	1.46	3.47	0.04	0.00	0.00
N+0.00	B206	2958	V40x90	295	B.2.4.7-8	1.46	2.58	0.04	0.00	0.00
N+0.00	B206	2958	V40x90	345	B.2.4.7-8	1.46	3.34	0.03	0.00	0.00
N+0.00	B206	2958	V40x90	395	B.2.4.7-8	2.35	3.93	0.03	0.00	0.00
N+0.00	B206	2958	V40x90	395	B.2.4.7-8	2.25	3.95	0.06	0.00	0.00
N+0.00	B206	2958	V40x90	443	B.2.4.5-8	4.93	3.85	0.06	0.00	0.00
N+0.00	B206	2958	V40x90	490	B.2.4.5-8	8.53	4.02	0.06	0.00	0.00
N+0.00	B206	2958	V40x90	490	B.2.4.5-8	4.90	2.62	0.03	0.00	0.00
N+0.00	B206	2958	V40x90	529	B.2.4.5-8	4.19	2.56	0.03	0.00	0.00
N+0.00	B206	2958	V40x90	567	B.2.4.5-8	3.60	2.47	0.03	0.00	0.00
N+0.00	B206	2958	V40x90	606	B.2.4.5-8	3.15	2.35	0.03	0.00	0.00
N+0.00	B206	2958	V40x90	645	B.2.4.5-8	2.83	2.20	0.03	0.00	0.00
N+0.00	B206	2958	V40x90	645	B.2.4.5-8	2.91	2.34	0.04	16.68	0.07
N+0.00	B206	2958	V40x90	688	B.2.4.5-8	4.02	1.86	0.04	16.68	0.07
N+0.00	B216	279	V50x90	15	B.2.4.5-3	4.37	2.12	0.18	0.00	0.00
N+0.00	B216	279	V50x90	62	B.2.4.5-3	4.66	4.66	0.17	0.00	0.00
N+0.00	B216	279	V50x90	110	B.2.4.5-3	4.66	4.66	0.17	0.00	0.00
N+0.00	B216	279	V50x90	157	B.2.4.5-3	4.66	6.15	0.17	0.00	0.00
N+0.00	B216	279	V50x90	157	B.2.4.5-3	4.94	6.29	0.19	0.00	0.00
N+0.00	B216	279	V50x90	201	B.2.4.5-3	4.94	10.87	0.19	0.00	0.00
N+0.00	B216	279	V50x90	245	B.2.4.5-3	4.94	14.17	0.18	0.00	0.00
N+0.00	B216	279	V50x90	289	B.2.4.7-4	0.22	14.78	0.18	0.00	0.00
N+0.00	B218	2181	V50x90	15	B.2.4.7-4	2.21	1.05	0.06	0.00	0.00
N+0.00	B218	2181	V50x90	62	B.2.4.7-4	0.88	1.19	0.06	0.00	0.00
N+0.00	B218	2181	V50x90	110	B.2.4.7-4	0.88	1.47	0.06	0.00	0.00
N+0.00	B218	2181	V50x90	157	B.2.4.7-4	0.88	2.03	0.05	0.00	0.00
N+0.00	B218	2181	V50x90	157	B.2.4.7-4	1.13	2.51	0.04	0.00	0.00
N+0.00	B218	2181	V50x90	201	B.2.4.7-4	1.13	3.20	0.05	0.00	0.00
N+0.00	B218	2181	V50x90	245	B.2.4.7-4	1.13	3.77	0.05	0.00	0.00
N+0.00	B218	2181	V50x90	289	B.2.4.7-4	1.29	4.56	0.05	0.00	0.00
N+0.00	B80	255	V50x90	25	B.2.4.5-3	5.08	3.21	0.05	0.00	0.00
N+0.00	B80	255	V50x90	67	B.2.4.5-3	4.45	2.26	0.05	0.00	0.00
N+0.00	B80	255	V50x90	108	B.2.4.5-3	3.95	2.26	0.04	0.00	0.00
N+0.00	B80	255	V50x90	150	B.2.4.5-3	3.58	2.26	0.04	0.00	0.00
N+0.00	B80	255	V50x90	150	B.2.4.5-8	2.05	1.95	0.05	0.00	0.00
N+0.00	B80	255	V50x90	200	B.2.4.5-8	1.95	1.95	0.05	0.00	0.00
N+0.00	B80	255	V50x90	249	B.2.4.5-8	1.95	1.95	0.04	0.00	0.00
N+0.00	B80	255	V50x90	299	B.2.4.5-8	1.95	2.16	0.04	0.00	0.00
N+0.00	B80	255	V50x90	299	B.2.4.5-8	1.83	3.07	0.05	0.00	0.00
N+0.00	B80	255	V50x90	341	B.2.4.5-8	1.83	3.58	0.04	0.00	0.00
N+0.00	B80	255	V50x90	382	B.2.4.5-8	1.83	3.99	0.04	0.00	0.00
N+0.00	B80	255	V50x90	424	B.2.4.7-4	1.36	4.28	0.04	0.00	0.00
N+0.00	B705	194	V40x90	0	B.2.4.5-8	5.35	2.54	0.05	0.00	0.00
N+0.00	B705	194	V40x90	37	B.2.4.5-8	3.63	1.83	0.05	0.00	0.00
N+0.00	B705	194	V40x90	74	B.2.4.7-8	2.38	2.01	0.04	0.00	0.00
N+0.00	B705	194	V40x90	111	B.2.4.7-8	1.63	2.04	0.04	0.00	0.00
N+0.00	B705	194	V40x90	111	B.2.4.7-8	1.80	2.17	0.04	0.00	0.00
N+0.00	B705	194	V40x90	158	B.2.4.5-8	1.26	2.17	0.04	0.00	0.00
N+0.00	B705	194	V40x90	158	B.2.4.5-8	1.26	2.17	0.04	0.00	0.00
N+0.00	B705	194	V40x90	194	B.2.4.5-8	1.26	1.89	0.03	0.00	0.00
N+0.00	B705	194	V40x90	230	B.2.4.5-8	1.26	1.35	0.03	0.00	0.00
N+0.00	B705	194	V40x90	266	B.2.4.5-8	1.26	1.26	0.04	0.00	0.00
N+0.00	B705	194	V40x90	266	B.2.4.5-8	1.61	1.61	0.03	0.00	0.00
N+0.00	B705	194	V40x90	305	B.2.4.5-8	1.61	1.61	0.04	0.00	0.00

360

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station	As Top Combo	As Top	As Bottom	At Shear	At Torsion	At Torsion
				cm		cm ²	cm ²	cm ² /cm	cm ²	cm ² /cm
N+0.00	B705	194	V40x90	343	B.2.4.7-8	1.75	1.61	0.04	0.00	0.00
N+0.00	B705	194	V40x90	382	B.2.4.5-8	3.24	1.61	0.05	0.00	0.00
N+0.00	B705	194	V40x90	420	B.2.4.5-8	5.11	2.66	0.05	0.00	0.00
N+0.00	B754	2344	V30X90	0	B.2.4.5-8	0.97	0.65	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	37	B.2.4.7-8	0.55	0.55	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	74	B.2.4.7-8	0.55	0.84	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	111	B.2.4.7-8	0.55	1.24	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	111	B.2.4.7-4	0.50	0.61	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	150	B.2.4.7-4	0.50	0.81	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	188	B.2.4.7-4	0.50	0.91	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	227	B.2.4.7-4	0.50	0.88	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	266	B.2.4.7-4	0.50	0.77	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	266	B.2.4.7-4	0.48	2.25	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	304	B.2.4.7-4	0.48	1.50	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	343	B.2.4.7-4	0.48	0.66	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	381	B.2.4.5-3	0.92	0.48	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	420	B.2.4.5-3	2.00	0.48	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	420	B.2.4.5-3	1.28	0.46	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	470	B.2.4.7-4	0.46	0.46	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	520	B.2.4.7-4	0.46	1.06	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	570	B.2.4.7-4	0.46	1.69	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	570	B.2.4.7-8	0.39	0.58	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	620	B.2.4.7-8	0.39	0.62	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	670	B.2.4.7-8	0.39	0.53	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	720	B.2.4.7-8	0.42	0.39	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	720	B.2.4.7-8	0.43	0.44	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	761	B.2.4.7-8	0.43	0.50	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	801	B.2.4.7-8	0.43	0.47	0.00	0.00	0.00
N+0.00	B754	2344	V30X90	842	B.2.4.7-8	0.46	0.39	0.00	0.00	0.00
N+0.00	B755	2345	V30X90	25	B.2.4.5-8	0.52	1.30	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	60	B.2.4.5-8	0.72	1.30	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	95	B.2.4.5-8	0.72	1.22	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	95	B.2.4.5-8	0.53	0.59	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	145	B.2.4.5-8	0.53	0.69	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	195	B.2.4.5-8	0.53	0.58	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	245	B.2.4.5-8	0.53	0.53	0.02	0.00	0.00
N+0.00	B755	2345	V30X90	245	B.2.4.5-8	0.92	0.75	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	295	B.2.4.5-8	1.01	0.75	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	345	B.2.4.5-8	1.29	0.75	0.02	0.00	0.00
N+0.00	B755	2345	V30X90	395	B.2.4.5-8	1.75	0.75	0.02	0.00	0.00
N+0.00	B755	2345	V30X90	395	B.2.4.5-8	2.09	0.94	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	443	B.2.4.5-8	2.12	0.94	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	490	B.2.4.5-8	2.29	0.94	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	490	B.2.4.7-8	0.41	0.40	0.02	0.00	0.00
N+0.00	B755	2345	V30X90	529	B.2.4.7-8	0.40	0.44	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	567	B.2.4.7-8	0.40	0.51	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	606	B.2.4.7-8	0.40	0.50	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	645	B.2.4.7-8	0.40	0.42	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	645	B.2.4.7-4	0.47	0.47	0.01	0.00	0.00
N+0.00	B755	2345	V30X90	688	B.2.4.7-4	0.35	0.52	0.01	0.00	0.00
N+0.00	B296	171	V50x90	25	B.2.4.5-8	3.20	2.30	0.02	0.00	0.00
N+0.00	B296	171	V50x90	59	B.2.4.5-8	2.97	1.84	0.02	0.00	0.00
N+0.00	B296	171	V50x90	94	B.2.4.5-8	2.86	1.84	0.01	0.00	0.00
N+0.00	B296	171	V50x90	128	B.2.4.5-8	2.85	1.84	0.02	0.00	0.00
N+0.00	B296	171	V50x90	128	B.2.4.5-8	2.29	1.51	0.02	0.00	0.00
N+0.00	B296	171	V50x90	178	B.2.4.5-8	1.76	1.51	0.02	0.00	0.00
N+0.00	B296	171	V50x90	228	B.2.4.5-8	1.51	1.51	0.02	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station	As Top Combo	As Top	As Bottom	At Shear	At Torsion	At Torsion
				cm		cm ²	cm ²	cm ² /cm	cm ²	cm ² /cm
N+0.00	B296	171	V50x90	278	B.2.4.5-8	1.51	1.51	0.02	0.00	0.00
N+0.00	B296	171	V50x90	278	B.2.4.5-8	1.16	1.16	0.02	0.00	0.00
N+0.00	B296	171	V50x90	328	B.2.4.5-8	1.16	1.16	0.02	0.00	0.00
N+0.00	B296	171	V50x90	378	B.2.4.5-8	1.16	1.16	0.02	0.00	0.00
N+0.00	B296	171	V50x90	428	B.2.4.5-8	1.55	1.16	0.02	0.00	0.00
N+0.00	B296	171	V50x90	428	B.2.4.5-8	1.41	1.14	0.02	0.00	0.00
N+0.00	B296	171	V50x90	462	B.2.4.5-8	1.39	1.31	0.02	0.00	0.00
N+0.00	B296	171	V50x90	497	B.2.4.5-8	1.46	1.36	0.02	0.00	0.00
N+0.00	B296	171	V50x90	531	B.2.4.5-8	1.66	1.30	0.02	0.00	0.00
N+0.00	B326	185	V50x90	50	B.2.4.7-8	3.01	4.98	0.04	0.00	0.00
N+0.00	B326	185	V50x90	95	B.2.4.7-8	2.96	4.71	0.05	0.00	0.00
N+0.00	B326	185	V50x90	95	B.2.4.7-8	2.93	3.54	0.05	0.00	0.00
N+0.00	B326	185	V50x90	145	B.2.4.7-8	2.53	3.39	0.04	0.00	0.00
N+0.00	B326	185	V50x90	195	B.2.4.7-8	2.29	3.00	0.05	0.00	0.00
N+0.00	B326	185	V50x90	245	B.2.4.5-8	2.27	2.36	0.05	0.00	0.00
N+0.00	B326	185	V50x90	245	B.2.4.5-8	2.63	2.63	0.04	0.00	0.00
N+0.00	B326	185	V50x90	295	B.2.4.5-8	2.63	2.63	0.05	0.00	0.00
N+0.00	B326	185	V50x90	345	B.2.4.5-8	2.82	2.63	0.05	0.00	0.00
N+0.00	B326	185	V50x90	395	B.2.4.5-8	3.72	2.63	0.05	0.00	0.00
N+0.00	B326	185	V50x90	395	B.2.4.5-8	4.92	2.89	0.04	0.00	0.00
N+0.00	B326	185	V50x90	430	B.2.4.5-8	5.08	2.89	0.04	0.00	0.00
N+0.00	B326	185	V50x90	465	B.2.4.5-8	5.35	3.67	0.05	0.00	0.00
N+0.00	B328	2183	V50x90	50	B.2.4.5-3	4.61	4.68	0.09	0.00	0.00
N+0.00	B328	2183	V50x90	84	B.2.4.7-4	2.68	4.18	0.08	0.00	0.00
N+0.00	B328	2183	V50x90	117	B.2.4.5-3	1.50	4.02	0.08	0.00	0.00
N+0.00	B328	2183	V50x90	151	B.2.4.5-3	1.50	3.76	0.08	0.00	0.00
N+0.00	B328	2183	V50x90	151	B.2.4.5-3	1.84	3.99	0.06	0.00	0.00
N+0.00	B328	2183	V50x90	189	B.2.4.5-3	1.84	3.00	0.06	0.00	0.00
N+0.00	B328	2183	V50x90	227	B.2.4.5-3	1.84	2.97	0.06	0.00	0.00
N+0.00	B328	2183	V50x90	264	B.2.4.5-3	1.84	3.38	0.07	0.00	0.00
N+0.00	B328	2183	V50x90	302	B.2.4.7-4	1.94	3.66	0.07	0.00	0.00
N+0.00	B328	2183	V50x90	302	B.2.4.7-4	2.26	3.91	0.08	0.00	0.00
N+0.00	B328	2183	V50x90	336	B.2.4.7-4	3.56	3.51	0.08	0.00	0.00
N+0.00	B328	2183	V50x90	369	B.2.4.5-3	5.14	3.38	0.09	0.00	0.00
N+0.00	B328	2183	V50x90	403	B.2.4.5-3	7.10	3.80	0.09	0.00	0.00
N+0.00	B339	3287	V50x90	50	B.2.4.7-4	4.09	6.84	0.09	0.00	0.00
N+0.00	B339	3287	V50x90	84	B.2.4.5-3	2.71	6.46	0.09	0.00	0.00
N+0.00	B339	3287	V50x90	117	B.2.4.5-3	2.71	5.96	0.09	0.00	0.00
N+0.00	B339	3287	V50x90	151	B.2.4.5-3	2.71	5.37	0.08	0.00	0.00
N+0.00	B339	3287	V50x90	151	B.2.4.5-3	2.38	4.98	0.08	0.00	0.00
N+0.00	B339	3287	V50x90	189	B.2.4.5-3	2.38	3.71	0.08	0.00	0.00
N+0.00	B339	3287	V50x90	227	B.2.4.5-3	2.38	3.35	0.09	0.00	0.00
N+0.00	B339	3287	V50x90	264	B.2.4.5-3	2.38	3.42	0.09	0.00	0.00
N+0.00	B339	3287	V50x90	302	B.2.4.5-3	2.38	3.37	0.09	0.00	0.00
N+0.00	B339	3287	V50x90	302	B.2.4.5-3	2.64	3.58	0.11	0.00	0.00
N+0.00	B339	3287	V50x90	336	B.2.4.5-3	4.08	2.89	0.11	0.00	0.00
N+0.00	B339	3287	V50x90	369	B.2.4.5-3	6.18	2.67	0.11	0.00	0.00
N+0.00	B339	3287	V50x90	403	B.2.4.5-3	8.42	4.56	0.11	0.00	0.00
N+0.00	B341	2241	V50x90	25	B.2.4.5-3	8.93	4.20	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	56	B.2.4.5-3	5.24	1.86	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	88	B.2.4.5-3	1.86	1.86	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	88	B.2.4.5-3	2.22	2.22	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	138	B.2.4.5-3	2.22	3.31	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	188	B.2.4.5-3	2.22	5.18	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	238	B.2.4.5-3	2.22	6.90	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	238	B.2.4.5-3	2.55	7.08	0.00	0.00	0.00
N+0.00	B341	2241	V50x90	288	B.2.4.5-3	2.55	7.45	0.00	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station	As Top Combo	As Top	As Bottom	At Shear	At Torsion	At Torsion
				cm		cm ²	cm ²	cm ² /cm	cm ²	cm ² /cm
N+0.00	B341	2241	V50x90	338	B.2.4.5-3	2.55	7.69	0.00	0.00	0.00
N+0.00	B341	2241	V50x90	388	B.2.4.5-3	2.55	7.86	0.00	0.00	0.00
N+0.00	B341	2241	V50x90	388	B.2.4.5-3	2.81	8.05	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	438	B.2.4.5-3	2.81	7.37	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	488	B.2.4.5-3	2.81	6.49	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	538	B.2.4.5-3	2.81	5.41	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	538	B.2.4.5-3	3.03	5.58	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	588	B.2.4.5-3	3.03	4.15	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	638	B.2.4.5-3	3.03	3.03	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	688	B.2.4.5-3	3.48	3.03	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	688	B.2.4.5-3	3.61	3.14	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	731	B.2.4.5-3	5.13	3.14	0.04	0.00	0.00
N+0.00	B341	2241	V50x90	775	B.2.4.5-3	6.83	3.81	0.04	0.00	0.00
N+0.00	B355	2973	V50x90	15	B.2.4.7-4	0.82	2.83	0.05	0.00	0.00
N+0.00	B355	2973	V50x90	62	B.2.4.7-4	0.88	2.67	0.05	0.00	0.00
N+0.00	B355	2973	V50x90	110	B.2.4.7-4	0.88	2.30	0.04	0.00	0.00
N+0.00	B355	2973	V50x90	157	B.2.4.7-4	0.88	2.12	0.04	0.00	0.00
N+0.00	B355	2973	V50x90	157	B.2.4.7-4	1.19	2.67	0.07	0.00	0.00
N+0.00	B355	2973	V50x90	201	B.2.4.7-4	1.19	2.10	0.07	0.00	0.00
N+0.00	B355	2973	V50x90	245	B.2.4.7-4	1.93	2.08	0.07	0.00	0.00
N+0.00	B355	2973	V50x90	289	B.2.4.5-3	4.21	2.14	0.08	0.00	0.00
N+0.00	B392	1893	V50x90	50	B.2.4.5-3	4.50	4.47	0.08	0.00	0.00
N+0.00	B392	1893	V50x90	84	B.2.4.7-4	2.93	3.73	0.07	0.00	0.00
N+0.00	B392	1893	V50x90	117	B.2.4.5-3	1.99	3.03	0.07	0.00	0.00
N+0.00	B392	1893	V50x90	151	B.2.4.5-3	1.99	2.41	0.07	0.00	0.00
N+0.00	B392	1893	V50x90	151	B.2.4.5-3	2.37	2.77	0.06	0.00	0.00
N+0.00	B392	1893	V50x90	189	B.2.4.5-3	2.37	2.37	0.06	0.00	0.00
N+0.00	B392	1893	V50x90	227	B.2.4.5-3	2.37	2.37	0.07	0.00	0.00
N+0.00	B392	1893	V50x90	264	B.2.4.5-3	2.37	2.37	0.07	0.00	0.00
N+0.00	B392	1893	V50x90	302	B.2.4.7-4	2.83	2.37	0.07	0.00	0.00
N+0.00	B392	1893	V50x90	302	B.2.4.7-4	3.18	2.77	0.08	0.00	0.00
N+0.00	B392	1893	V50x90	336	B.2.4.5-3	4.72	2.77	0.09	0.00	0.00
N+0.00	B392	1893	V50x90	369	B.2.4.5-3	6.39	2.77	0.09	0.00	0.00
N+0.00	B392	1893	V50x90	403	B.2.4.5-3	8.19	4.56	0.09	0.00	0.00
N+0.00	B393	1823	V50x90	25	B.2.4.5-8	13.81	6.96	0.04	0.00	0.00
N+0.00	B393	1823	V50x90	56	B.2.4.5-8	10.18	3.59	0.04	0.00	0.00
N+0.00	B393	1823	V50x90	88	B.2.4.5-8	6.67	3.59	0.04	0.00	0.00
N+0.00	B393	1823	V50x90	88	B.2.4.5-8	6.61	3.48	0.04	0.00	0.00
N+0.00	B393	1823	V50x90	138	B.2.4.5-8	3.64	3.48	0.04	0.00	0.00
N+0.00	B393	1823	V50x90	188	B.2.4.5-8	3.48	3.48	0.04	0.00	0.00
N+0.00	B393	1823	V50x90	238	B.2.4.5-8	3.48	3.76	0.04	0.00	0.00
N+0.00	B393	1823	V50x90	238	B.2.4.5-3	3.41	3.69	0.00	0.00	0.00
N+0.00	B393	1823	V50x90	288	B.2.4.5-3	3.41	4.52	0.00	0.00	0.00
N+0.00	B393	1823	V50x90	338	B.2.4.5-3	3.41	5.10	0.00	0.00	0.00
N+0.00	B393	1823	V50x90	388	B.2.4.5-3	3.41	5.44	0.00	0.00	0.00
N+0.00	B393	1823	V50x90	388	B.2.4.5-8	3.46	5.37	0.00	0.00	0.00
N+0.00	B393	1823	V50x90	426	B.2.4.5-8	3.46	5.28	0.00	0.00	0.00
N+0.00	B393	1823	V50x90	465	B.2.4.5-8	3.46	5.05	0.00	0.00	0.00
N+0.00	B393	1823	V50x90	465	B.2.4.5-8	3.46	5.05	0.00	0.00	0.00
N+0.00	B393	1823	V50x90	501	B.2.4.5-8	3.46	4.69	0.00	0.00	0.00
N+0.00	B393	1823	V50x90	538	B.2.4.5-8	3.46	4.21	0.00	0.00	0.00
N+0.00	B393	1823	V50x90	538	B.2.4.5-8	3.52	4.14	0.00	0.00	0.00
N+0.00	B393	1823	V50x90	588	B.2.4.5-8	3.52	3.63	0.00	0.00	0.00
N+0.00	B393	1823	V50x90	638	B.2.4.5-8	3.52	3.52	0.00	0.00	0.00
N+0.00	B393	1823	V50x90	688	B.2.4.5-8	3.52	3.52	0.00	0.00	0.00
N+0.00	B393	1823	V50x90	688	B.2.4.5-8	3.56	3.56	0.00	0.00	0.00
N+0.00	B393	1823	V50x90	731	B.2.4.5-8	3.56	3.56	0.00	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station	As Top Combo	As Top	As Bottom	At Shear	At Torsion	At Torsion
				cm		cm ²	cm ²	cm ² /cm	cm ²	cm ² /cm
N+0.00	B393	1823	V50x90	775	B.2.4.7-8	0.25	0.77	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	0	B.2.4.5-8	0.41	0.50	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	44	B.2.4.5-8	0.66	0.87	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	88	B.2.4.5-8	0.66	1.19	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	88	B.2.4.5-8	0.74	1.27	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	138	B.2.4.5-8	0.74	2.00	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	188	B.2.4.5-8	0.74	2.50	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	238	B.2.4.5-8	0.74	2.76	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	238	B.2.4.5-8	0.83	2.86	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	288	B.2.4.5-8	0.83	3.34	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	338	B.2.4.5-8	0.83	3.59	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	388	B.2.4.5-8	0.83	3.60	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	388	B.2.4.5-3	0.89	3.66	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	438	B.2.4.5-3	0.89	3.82	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	488	B.2.4.5-3	0.89	3.75	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	538	B.2.4.5-3	0.89	3.45	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	538	B.2.4.5-3	0.93	3.47	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	588	B.2.4.5-3	0.93	3.41	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	638	B.2.4.5-3	0.93	3.11	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	688	B.2.4.5-3	0.93	2.58	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	688	B.2.4.5-3	0.97	2.62	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	731	B.2.4.5-3	0.97	2.43	0.00	0.00	0.00
N+0.00	B394	1826	V50x90	775	B.2.4.7-4	0.59	2.08	0.00	0.00	0.00
N+0.00	B398	2975	V50x90	15	B.2.4.5-3	1.98	0.97	0.05	0.00	0.00
N+0.00	B398	2975	V50x90	62	B.2.4.7-4	0.95	0.95	0.04	0.00	0.00
N+0.00	B398	2975	V50x90	110	B.2.4.5-3	0.95	0.95	0.04	0.00	0.00
N+0.00	B398	2975	V50x90	157	B.2.4.5-3	0.95	0.95	0.04	0.00	0.00
N+0.00	B398	2975	V50x90	157	B.2.4.5-3	0.99	0.99	0.04	0.00	0.00
N+0.00	B398	2975	V50x90	201	B.2.4.5-3	1.42	1.06	0.05	0.00	0.00
N+0.00	B398	2975	V50x90	245	B.2.4.5-3	2.77	1.24	0.05	0.00	0.00
N+0.00	B398	2975	V50x90	289	B.2.4.5-3	4.32	2.10	0.05	0.00	0.00
N+0.00	B399	745	V30X90	25	B.2.4.4-4	0.00	0.44	0.01	0.00	0.00
N+0.00	B399	745	V30X90	63	B.2.4.4-4	0.00	0.43	0.01	0.00	0.00
N+0.00	B399	745	V30X90	102	B.2.4.4-4	0.00	0.30	0.01	0.00	0.00
N+0.00	B399	745	V30X90	140	B.2.4.4-4	0.00	0.10	0.01	0.00	0.00
N+0.00	B399	745	V30X90	140	B.2.4.7-8	0.17	0.17	0.01	0.00	0.00
N+0.00	B399	745	V30X90	178	B.2.4.7-8	0.17	0.17	0.01	0.00	0.00
N+0.00	B399	745	V30X90	217	B.2.4.7-8	0.20	0.17	0.01	0.00	0.00
N+0.00	B399	745	V30X90	255	B.2.4.7-8	0.34	0.20	0.01	0.00	0.00
N+0.00	B401	812	V30X90	25	B.2.4.5-8	2.36	3.02	0.07	0.00	0.00
N+0.00	B401	812	V30X90	71	B.2.4.5-8	3.20	3.20	0.07	0.00	0.00
N+0.00	B401	812	V30X90	117	B.2.4.5-8	3.20	3.20	0.07	0.00	0.00
N+0.00	B401	812	V30X90	163	B.2.4.5-8	3.89	3.20	0.07	0.00	0.00
N+0.00	B401	812	V30X90	209	B.2.4.5-8	4.77	3.20	0.08	0.00	0.00
N+0.00	B401	812	V30X90	255	B.2.4.5-8	5.66	4.05	0.08	0.00	0.00
N+0.00	B404	860	V30X90	15	B.2.4.7-8	0.06	0.61	0.01	0.00	0.00
N+0.00	B404	860	V30X90	62	B.2.4.7-8	0.18	0.71	0.01	0.00	0.00
N+0.00	B404	860	V30X90	110	B.2.4.7-8	0.18	0.67	0.01	0.00	0.00
N+0.00	B404	860	V30X90	157	B.2.4.7-8	0.18	0.52	0.01	0.00	0.00
N+0.00	B404	860	V30X90	157	B.2.4.7-8	0.54	0.73	0.01	0.00	0.00
N+0.00	B404	860	V30X90	196	B.2.4.7-8	0.54	0.75	0.01	0.00	0.00
N+0.00	B404	860	V30X90	236	B.2.4.7-8	0.54	0.73	0.01	0.00	0.00
N+0.00	B404	860	V30X90	275	B.2.4.7-8	0.54	0.65	0.01	0.00	0.00
N+0.00	B404	860	V30X90	314	B.2.4.7-8	0.43	0.52	0.01	0.00	0.00
N+0.00	B405	861	V30X90	0	B.2.4.7-8	0.72	0.68	0.02	0.00	0.00
N+0.00	B405	861	V30X90	47	B.2.4.7-8	0.47	0.63	0.02	0.00	0.00
N+0.00	B405	861	V30X90	94	B.2.4.7-8	0.47	0.61	0.02	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station	As Top Combo	As Top	As Bottom	At Shear	At Torsion	At Torsion
				cm		cm ²	cm ²	cm ² /cm	cm ²	cm ² /cm
N+0.00	B405	861	V30X90	141	B.2.4.7-8	0.37	0.83	0.02	0.00	0.00
N+0.00	B1282	1995	V50x90	50	B.2.4.5-8	6.83	4.61	0.08	0.00	0.00
N+0.00	B1282	1995	V50x90	89	B.2.4.5-8	3.95	4.41	0.08	0.00	0.00
N+0.00	B1282	1995	V50x90	128	B.2.4.5-8	2.83	4.79	0.08	0.00	0.00
N+0.00	B1282	1995	V50x90	128	B.2.4.5-8	2.82	4.76	0.07	0.00	0.00
N+0.00	B1282	1995	V50x90	178	B.2.4.5-8	2.82	4.74	0.06	0.00	0.00
N+0.00	B1282	1995	V50x90	228	B.2.4.5-8	2.82	4.49	0.06	0.00	0.00
N+0.00	B1282	1995	V50x90	278	B.2.4.5-8	2.82	4.22	0.06	0.00	0.00
N+0.00	B1282	1995	V50x90	278	B.2.4.5-8	3.66	5.01	0.07	0.00	0.00
N+0.00	B1282	1995	V50x90	328	B.2.4.5-8	3.66	4.58	0.07	0.00	0.00
N+0.00	B1282	1995	V50x90	378	B.2.4.5-8	3.66	4.27	0.07	0.00	0.00
N+0.00	B1282	1995	V50x90	428	B.2.4.5-8	3.66	3.74	0.07	0.00	0.00
N+0.00	B1282	1995	V50x90	428	B.2.4.5-8	4.58	4.74	0.09	0.00	0.00
N+0.00	B1282	1995	V50x90	467	B.2.4.5-8	7.93	4.58	0.09	0.00	0.00
N+0.00	B1282	1995	V50x90	506	B.2.4.5-8	11.75	6.95	0.09	0.00	0.00
N+0.00	B1287	2141	V40x90	0	B.2.4.7-4	0.30	6.60	0.00	0.00	0.00
N+0.00	B1287	2141	V40x90	44	B.2.4.5-3	5.36	7.57	0.00	0.00	0.00
N+0.00	B1287	2141	V40x90	88	B.2.4.5-3	5.36	8.41	0.00	0.00	0.00
N+0.00	B1287	2141	V40x90	88	B.2.4.5-3	5.44	8.52	0.00	0.00	0.00
N+0.00	B1287	2141	V40x90	138	B.2.4.5-3	5.44	9.01	0.00	0.00	0.00
N+0.00	B1287	2141	V40x90	188	B.2.4.5-3	5.44	9.29	0.00	0.00	0.00
N+0.00	B1287	2141	V40x90	238	B.2.4.5-3	5.44	9.41	0.00	0.00	0.00
N+0.00	B1287	2141	V40x90	238	B.2.4.5-3	5.56	9.59	0.00	0.00	0.00
N+0.00	B1287	2141	V40x90	288	B.2.4.5-3	5.56	9.24	0.00	0.00	0.00
N+0.00	B1287	2141	V40x90	338	B.2.4.5-3	5.56	8.75	0.00	0.00	0.00
N+0.00	B1287	2141	V40x90	388	B.2.4.5-3	5.56	8.05	0.00	0.00	0.00
N+0.00	B1287	2141	V40x90	388	B.2.4.5-3	5.68	8.24	0.00	0.00	0.00
N+0.00	B1287	2141	V40x90	438	B.2.4.5-3	5.68	6.88	0.00	0.00	0.00
N+0.00	B1287	2141	V40x90	488	B.2.4.5-3	5.68	5.68	0.00	0.00	0.00
N+0.00	B1287	2141	V40x90	538	B.2.4.5-3	5.68	5.68	0.00	0.00	0.00
N+0.00	B1287	2141	V40x90	538	B.2.4.5-3	5.80	5.80	0.02	0.00	0.00
N+0.00	B1287	2141	V40x90	588	B.2.4.5-3	5.80	5.80	0.02	0.00	0.00
N+0.00	B1287	2141	V40x90	638	B.2.4.5-3	6.46	5.80	0.02	0.00	0.00
N+0.00	B1287	2141	V40x90	688	B.2.4.5-3	10.36	5.80	0.03	0.00	0.00
N+0.00	B1287	2141	V40x90	688	B.2.4.5-3	10.36	5.88	0.06	0.00	0.00
N+0.00	B1287	2141	V40x90	731	B.2.4.5-3	12.15	5.88	0.06	0.00	0.00
N+0.00	B1287	2141	V40x90	775	B.2.4.5-3	16.78	11.20	0.07	0.00	0.00
N+0.00	B1288	2995	V40x90	15	B.2.4.2-2	11.20	5.41	0.01	0.00	0.00
N+0.00	B1288	2995	V40x90	62	B.2.4.2-2	7.31	2.59	0.01	0.00	0.00
N+0.00	B1288	2995	V40x90	110	B.2.4.5-3	3.80	2.59	0.01	0.00	0.00
N+0.00	B1288	2995	V40x90	157	B.2.4.5-3	2.59	2.59	0.00	0.00	0.00
N+0.00	B1288	2995	V40x90	157	B.2.4.5-3	2.62	2.62	0.00	0.00	0.00
N+0.00	B1288	2995	V40x90	196	B.2.4.5-3	2.62	2.62	0.00	0.00	0.00
N+0.00	B1288	2995	V40x90	236	B.2.4.5-3	2.62	3.93	0.00	0.00	0.00
N+0.00	B1288	2995	V40x90	275	B.2.4.5-3	2.62	5.47	0.00	0.00	0.00
N+0.00	B1288	2995	V40x90	314	B.2.4.7-4	0.17	6.90	0.00	0.00	0.00
N+0.00	B1289	3281	V40x90	0	B.2.4.5-3	15.30	11.20	0.08	0.00	0.00
N+0.00	B1289	3281	V40x90	50	B.2.4.5-3	11.36	6.74	0.08	0.00	0.00
N+0.00	B1289	3281	V40x90	100	B.2.4.5-3	10.24	6.74	0.08	0.00	0.00
N+0.00	B1289	3281	V40x90	150	B.2.4.5-3	6.74	6.74	0.08	0.00	0.00
N+0.00	B1289	3281	V40x90	150	B.2.4.5-3	6.12	6.12	0.07	0.00	0.00
N+0.00	B1289	3281	V40x90	200	B.2.4.5-3	6.12	6.12	0.06	0.00	0.00
N+0.00	B1289	3281	V40x90	249	B.2.4.5-3	6.12	6.12	0.06	0.00	0.00
N+0.00	B1289	3281	V40x90	299	B.2.4.5-3	6.12	6.27	0.06	0.00	0.00
N+0.00	B1289	3281	V40x90	299	B.2.4.5-3	5.67	5.76	0.05	0.00	0.00
N+0.00	B1289	3281	V40x90	339	B.2.4.5-3	5.67	6.56	0.05	0.00	0.00
N+0.00	B1289	3281	V40x90	379	B.2.4.5-3	5.67	7.27	0.05	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station cm	As Top Combo	As Top cm ²	As Bottom cm ²	At Shear cm ² /cm	At Torsion cm ²	At Torsion cm ² /cm
N+0.00	B1289	3281	V40x90	379	B.2.4.5-3	5.67	7.27	0.05	0.00	0.00
N+0.00	B1289	3281	V40x90	414	B.2.4.5-3	5.67	7.79	0.05	0.00	0.00
N+0.00	B1289	3281	V40x90	449	B.2.4.5-3	5.67	8.23	0.05	0.00	0.00
N+0.00	B1289	3281	V40x90	449	B.2.4.5-3	5.35	7.85	0.05	0.00	0.00
N+0.00	B1289	3281	V40x90	489	B.2.4.5-3	5.35	8.11	0.05	0.00	0.00
N+0.00	B1289	3281	V40x90	529	B.2.4.5-3	5.35	8.31	0.04	0.00	0.00
N+0.00	B1289	3281	V40x90	570	B.2.4.5-3	5.35	8.39	0.04	0.00	0.00
N+0.00	B1289	3281	V40x90	570	B.2.4.5-3	5.35	8.39	0.04	0.00	0.00
N+0.00	B1289	3281	V40x90	579	B.2.4.5-3	5.35	8.39	0.04	0.00	0.00
N+0.00	B1289	3281	V40x90	579	B.2.4.5-3	5.12	8.13	0.04	0.00	0.00
N+0.00	B1289	3281	V40x90	622	B.2.4.5-3	5.12	7.95	0.05	0.00	0.00
N+0.00	B1289	3281	V40x90	666	B.2.4.5-3	5.12	7.62	0.05	0.00	0.00
N+0.00	B1289	3281	V40x90	709	B.2.4.7-4	0.67	7.20	0.05	0.00	0.00
N+0.00	B1290	3286	V40x90	0	B.2.4.7-4	0.44	7.10	0.00	0.00	0.00
N+0.00	B1290	3286	V40x90	38	B.2.4.5-3	3.84	6.60	0.00	0.00	0.00
N+0.00	B1290	3286	V40x90	76	B.2.4.5-3	3.84	6.00	0.00	0.00	0.00
N+0.00	B1290	3286	V40x90	113	B.2.4.5-3	3.84	5.26	0.00	0.00	0.00
N+0.00	B1290	3286	V40x90	151	B.2.4.5-3	3.84	4.41	0.00	0.00	0.00
N+0.00	B1290	3286	V40x90	151	B.2.4.5-3	3.67	4.31	0.00	0.00	0.00
N+0.00	B1290	3286	V40x90	189	B.2.4.5-3	3.67	3.67	0.00	0.00	0.00
N+0.00	B1290	3286	V40x90	227	B.2.4.5-3	3.67	3.67	0.00	0.00	0.00
N+0.00	B1290	3286	V40x90	264	B.2.4.5-3	3.67	3.67	0.00	0.00	0.00
N+0.00	B1290	3286	V40x90	302	B.2.4.5-3	4.86	3.67	0.00	0.00	0.00
N+0.00	B1290	3286	V40x90	302	B.2.4.5-3	4.65	3.52	0.00	0.00	0.00
N+0.00	B1290	3286	V40x90	347	B.2.4.5-3	7.54	3.52	0.00	0.00	0.00
N+0.00	B1290	3286	V40x90	393	B.2.4.5-3	10.64	3.52	0.01	0.00	0.00
N+0.00	B1290	3286	V40x90	438	B.2.4.4-4	11.20	6.96	0.01	0.00	0.00
N+0.00	B1292	2005	V40x90	0	B.2.4.5-3	3.09	2.63	0.06	0.00	0.00
N+0.00	B1292	2005	V40x90	39	B.2.4.5-8	2.79	2.49	0.05	0.00	0.00
N+0.00	B1292	2005	V40x90	77	B.2.4.5-8	2.71	2.49	0.05	0.00	0.00
N+0.00	B1292	2005	V40x90	116	B.2.4.5-8	2.81	2.49	0.05	0.00	0.00
N+0.00	B1292	2005	V40x90	155	B.2.4.5-8	3.05	2.49	0.05	0.00	0.00
N+0.00	B1292	2005	V40x90	155	B.2.4.5-8	3.35	3.08	0.05	0.00	0.00
N+0.00	B1292	2005	V40x90	198	B.2.4.5-8	3.37	3.12	0.05	0.00	0.00
N+0.00	B1917	256	V50x90	25	B.2.4.7-4	2.21	5.26	0.04	0.00	0.00
N+0.00	B1917	256	V50x90	60	B.2.4.5-8	2.39	4.72	0.04	0.00	0.00
N+0.00	B1917	256	V50x90	95	B.2.4.5-8	2.39	4.10	0.04	0.00	0.00
N+0.00	B1917	256	V50x90	130	B.2.4.5-8	2.39	3.39	0.04	0.00	0.00
N+0.00	B1917	256	V50x90	130	B.2.4.5-3	2.51	2.22	0.04	0.00	0.00
N+0.00	B1917	256	V50x90	173	B.2.4.5-3	2.74	2.22	0.04	0.00	0.00
N+0.00	B1917	256	V50x90	217	B.2.4.5-8	3.44	2.22	0.04	0.00	0.00
N+0.00	B1917	256	V50x90	260	B.2.4.5-8	4.38	2.22	0.04	0.00	0.00
N+0.00	B1917	256	V50x90	260	B.2.4.5-3	4.55	3.77	0.03	0.00	0.00
N+0.00	B1917	256	V50x90	298	B.2.4.5-3	4.18	3.77	0.03	0.00	0.00
N+0.00	B1917	256	V50x90	336	B.2.4.5-3	3.96	3.77	0.02	0.00	0.00
N+0.00	B1917	256	V50x90	373	B.2.4.5-3	3.88	3.77	0.02	0.00	0.00
N+0.00	B1917	256	V50x90	411	B.2.4.5-3	3.93	3.77	0.02	0.00	0.00
N+0.00	B1917	256	V50x90	411	B.2.4.5-3	3.39	3.34	0.03	0.00	0.00
N+0.00	B1917	256	V50x90	449	B.2.4.5-3	3.34	3.34	0.03	0.00	0.00
N+0.00	B1917	256	V50x90	487	B.2.4.5-3	3.34	3.34	0.02	0.00	0.00
N+0.00	B1917	256	V50x90	524	B.2.4.5-3	3.34	3.34	0.02	0.00	0.00
N+0.00	B1917	256	V50x90	562	B.2.4.5-3	3.46	3.34	0.02	0.00	0.00
N+0.00	B1917	256	V50x90	562	B.2.4.5-3	3.20	3.17	0.03	0.00	0.00
N+0.00	B1917	256	V50x90	604	B.2.4.5-3	3.11	3.45	0.02	0.00	0.00
N+0.00	B1917	256	V50x90	646	B.2.4.5-3	3.12	3.60	0.02	0.00	0.00
N+0.00	B1917	256	V50x90	688	B.2.4.5-3	3.28	3.61	0.02	0.00	0.00
N+0.00	B1918	3280	V50x90	0	B.2.4.5-3	16.19	11.96	0.10	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station cm	As Top Combo	As Top cm ²	As Bottom cm ²	At Shear cm ² /cm	At Torsion cm ²	At Torsion cm ² /cm
N+0.00	B1918	3280	V50x90	50	B.2.4.5-3	14.17	7.25	0.09	0.00	0.00
N+0.00	B1918	3280	V50x90	100	B.2.4.5-3	10.29	7.25	0.09	0.00	0.00
N+0.00	B1918	3280	V50x90	150	B.2.4.5-3	7.25	7.25	0.09	0.00	0.00
N+0.00	B1918	3280	V50x90	150	B.2.4.5-3	6.65	6.65	0.08	0.00	0.00
N+0.00	B1918	3280	V50x90	200	B.2.4.5-3	6.65	6.65	0.07	0.00	0.00
N+0.00	B1918	3280	V50x90	249	B.2.4.5-3	6.65	7.07	0.07	0.00	0.00
N+0.00	B1918	3280	V50x90	299	B.2.4.5-3	6.65	8.38	0.07	0.00	0.00
N+0.00	B1918	3280	V50x90	299	B.2.4.5-3	6.21	8.11	0.06	0.00	0.00
N+0.00	B1918	3280	V50x90	349	B.2.4.5-3	6.21	8.63	0.06	0.00	0.00
N+0.00	B1918	3280	V50x90	399	B.2.4.5-3	6.21	9.08	0.06	0.00	0.00
N+0.00	B1918	3280	V50x90	449	B.2.4.5-3	6.21	9.45	0.05	0.00	0.00
N+0.00	B1918	3280	V50x90	449	B.2.4.5-3	5.60	8.82	0.07	0.00	0.00
N+0.00	B1918	3280	V50x90	492	B.2.4.5-3	5.60	7.72	0.07	0.00	0.00
N+0.00	B1918	3280	V50x90	536	B.2.4.5-3	5.60	6.81	0.07	0.00	0.00
N+0.00	B1918	3280	V50x90	579	B.2.4.5-3	5.60	5.81	0.07	0.00	0.00
N+0.00	B1918	3280	V50x90	579	B.2.4.5-3	5.72	6.01	0.09	0.00	0.00
N+0.00	B1918	3280	V50x90	619	B.2.4.5-3	5.72	5.72	0.09	0.00	0.00
N+0.00	B1918	3280	V50x90	659	B.2.4.5-3	9.71	5.35	0.10	0.00	0.00
N+0.00	B1933	1827	V50x90	0	B.2.4.5-3	0.71	2.81	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	50	B.2.4.5-3	4.45	4.45	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	100	B.2.4.5-3	4.45	4.45	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	150	B.2.4.5-3	4.45	4.45	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	150	B.2.4.5-3	4.63	4.63	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	200	B.2.4.5-3	4.63	4.75	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	249	B.2.4.5-3	4.63	4.82	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	299	B.2.4.5-3	4.63	4.65	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	299	B.2.4.5-3	4.83	4.95	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	349	B.2.4.5-3	4.83	4.83	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	399	B.2.4.5-3	4.83	4.83	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	449	B.2.4.5-3	4.83	4.83	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	449	B.2.4.5-3	5.05	5.05	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	486	B.2.4.5-3	5.05	5.05	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	523	B.2.4.5-3	5.05	5.05	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	560	B.2.4.5-3	6.36	5.05	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	560	B.2.4.5-3	6.36	5.05	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	579	B.2.4.5-3	7.45	5.05	0.00	0.00	0.00
N+0.00	B1933	1827	V50x90	579	B.2.4.5-3	7.64	5.33	0.01	0.00	0.00
N+0.00	B1933	1827	V50x90	619	B.2.4.5-3	12.05	5.33	0.02	0.00	0.00
N+0.00	B1933	1827	V50x90	659	B.2.4.2-2	14.17	9.07	0.02	0.00	0.00
N+0.00	B2589	3277	V50x90	63	B.2.4.7-8	7.39	8.08	0.10	0.00	0.00
N+0.00	B2589	3277	V50x90	95	B.2.4.5-8	7.01	5.81	0.11	0.00	0.00
N+0.00	B2589	3277	V50x90	95	B.2.4.5-8	5.01	4.25	0.09	0.00	0.00
N+0.00	B2589	3277	V50x90	145	B.2.4.7-8	3.21	3.11	0.08	0.00	0.00
N+0.00	B2589	3277	V50x90	195	B.2.4.7-8	1.65	1.83	0.08	0.00	0.00
N+0.00	B2589	3277	V50x90	245	B.2.4.7-8	1.65	1.65	0.07	0.00	0.00
N+0.00	B2589	3277	V50x90	245	B.2.4.7-8	2.26	2.26	0.07	0.00	0.00
N+0.00	B2589	3277	V50x90	295	B.2.4.7-8	2.26	2.26	0.08	0.00	0.00
N+0.00	B2589	3277	V50x90	345	B.2.4.7-8	2.95	2.84	0.08	0.00	0.00
N+0.00	B2589	3277	V50x90	395	B.2.4.7-8	4.71	3.88	0.09	0.00	0.00
N+0.00	B2589	3277	V50x90	395	B.2.4.7-8	5.44	4.75	0.11	0.00	0.00
N+0.00	B2589	3277	V50x90	440	B.2.4.5-8	8.82	5.74	0.11	0.00	0.00
N+0.00	B2592	4369	V50x90	50	B.2.4.5-3	14.17	9.03	0.04	0.00	0.00
N+0.00	B2592	4369	V50x90	85	B.2.4.5-8	12.58	5.35	0.04	0.00	0.00
N+0.00	B2592	4369	V50x90	120	B.2.4.5-8	8.82	5.35	0.04	0.00	0.00
N+0.00	B2592	4369	V50x90	155	B.2.4.5-8	5.35	5.35	0.04	0.00	0.00
N+0.00	B2592	4369	V50x90	155	B.2.4.5-8	4.48	4.48	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	193	B.2.4.5-8	4.48	4.48	0.00	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station	As Top Combo	As Top	As Bottom	At Shear	At Torsion	At Torsion
				cm		cm ²	cm ²	cm ² /cm	cm ²	cm ² /cm
N+0.00	B2592	4369	V50x90	232	B.2.4.5-8	4.48	4.48	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	270	B.2.4.5-8	4.48	5.22	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	309	B.2.4.5-8	4.48	6.25	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	309	B.2.4.5-8	4.25	6.00	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	348	B.2.4.5-8	4.25	6.43	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	386	B.2.4.5-8	4.25	6.72	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	425	B.2.4.5-8	4.25	6.85	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	464	B.2.4.5-8	4.25	6.84	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	464	B.2.4.5-8	4.57	6.76	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	502	B.2.4.5-8	4.57	6.65	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	541	B.2.4.5-8	4.57	6.40	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	579	B.2.4.5-8	4.57	5.99	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	618	B.2.4.5-8	4.57	5.44	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	618	B.2.4.5-8	4.94	5.64	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	668	B.2.4.5-8	4.94	5.64	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	718	B.2.4.5-8	4.94	5.44	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	768	B.2.4.5-8	4.94	5.03	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	768	B.2.4.5-8	5.47	5.60	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	818	B.2.4.5-8	5.47	5.47	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	868	B.2.4.5-8	5.47	5.47	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	918	B.2.4.5-8	5.47	5.47	0.00	0.00	0.00
N+0.00	B2592	4369	V50x90	918	B.2.4.5-8	6.25	6.25	0.04	0.00	0.00
N+0.00	B2592	4369	V50x90	967	B.2.4.5-8	9.48	6.25	0.04	0.00	0.00
N+0.00	B2592	4369	V50x90	1015	B.2.4.5-8	13.81	8.17	0.04	0.00	0.00
N+0.00	B2594	172	V50x90	25	B.2.4.7-8	1.04	0.84	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	68	B.2.4.7-8	0.81	1.03	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	111	B.2.4.7-8	0.70	1.09	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	155	B.2.4.7-8	0.72	1.03	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	155	B.2.4.5-3	1.06	0.72	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	193	B.2.4.7-4	0.72	0.89	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	232	B.2.4.7-4	0.72	1.26	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	270	B.2.4.7-4	0.72	1.51	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	309	B.2.4.7-4	0.72	1.63	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	309	B.2.4.7-4	0.78	1.72	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	348	B.2.4.7-4	0.78	1.75	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	386	B.2.4.7-4	0.78	1.65	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	425	B.2.4.7-4	0.78	1.40	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	464	B.2.4.7-4	0.78	1.03	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	464	B.2.4.7-4	0.81	3.22	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	502	B.2.4.7-4	0.81	2.21	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	541	B.2.4.7-4	0.81	1.08	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	579	B.2.4.5-3	1.36	0.81	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	618	B.2.4.5-3	2.79	0.81	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	618	B.2.4.5-3	1.84	0.83	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	668	B.2.4.7-4	0.83	0.83	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	718	B.2.4.7-4	0.83	1.54	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	768	B.2.4.7-4	0.83	2.27	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	768	B.2.4.7-4	0.83	1.14	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	818	B.2.4.7-4	0.83	1.24	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	868	B.2.4.7-4	0.83	1.11	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	918	B.2.4.7-4	1.10	0.87	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	918	B.2.4.7-8	1.14	0.95	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	959	B.2.4.7-8	1.12	1.02	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	999	B.2.4.7-8	1.21	0.99	0.00	0.00	0.00
N+0.00	B2594	172	V50x90	1040	B.2.4.5-8	1.45	1.04	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	25	B.2.4.5-8	12.84	6.84	0.04	0.00	0.00
N+0.00	B2606	2949	V50x90	68	B.2.4.5-8	8.93	4.68	0.04	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station cm	As Top Combo	As Top cm ²	As Bottom cm ²	At Shear cm ² /cm	At Torsion cm ²	At Torsion cm ² /cm
N+0.00	B2606	2949	V50x90	111	B.2.4.5-8	5.26	4.68	0.04	0.00	0.00
N+0.00	B2606	2949	V50x90	155	B.2.4.5-8	4.68	4.68	0.04	0.00	0.00
N+0.00	B2606	2949	V50x90	155	B.2.4.5-8	4.59	4.59	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	193	B.2.4.5-8	4.59	4.59	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	232	B.2.4.5-8	4.59	5.37	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	270	B.2.4.5-8	4.59	6.58	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	309	B.2.4.5-8	4.59	7.66	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	309	B.2.4.5-8	4.48	7.57	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	348	B.2.4.5-8	4.48	8.13	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	386	B.2.4.5-8	4.48	8.55	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	425	B.2.4.5-8	4.48	8.80	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	464	B.2.4.5-8	4.48	8.91	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	464	B.2.4.5-8	4.40	8.90	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	502	B.2.4.5-8	4.40	8.81	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	541	B.2.4.5-8	4.40	8.58	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	579	B.2.4.5-8	4.40	8.18	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	618	B.2.4.5-8	4.40	7.64	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	618	B.2.4.5-8	4.33	8.01	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	668	B.2.4.5-8	4.33	7.22	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	718	B.2.4.5-8	4.33	6.18	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	768	B.2.4.5-8	4.33	4.89	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	768	B.2.4.5-8	4.34	5.09	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	818	B.2.4.5-8	4.34	4.34	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	868	B.2.4.5-8	4.34	4.34	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	918	B.2.4.5-8	4.34	4.34	0.00	0.00	0.00
N+0.00	B2606	2949	V50x90	918	B.2.4.5-8	4.47	4.47	0.04	0.00	0.00
N+0.00	B2606	2949	V50x90	959	B.2.4.5-8	7.60	4.47	0.04	0.00	0.00
N+0.00	B2606	2949	V50x90	999	B.2.4.5-8	11.65	4.47	0.04	0.00	0.00
N+0.00	B2606	2949	V50x90	1040	B.2.4.2-2	14.17	8.24	0.04	0.00	0.00
N+0.00	B2609	2939	V50x90	0	B.2.4.5-8	4.47	2.25	0.05	0.00	0.00
N+0.00	B2609	2939	V50x90	48	B.2.4.5-8	2.75	1.69	0.05	0.00	0.00
N+0.00	B2609	2939	V50x90	95	B.2.4.5-8	1.69	1.69	0.05	0.00	0.00
N+0.00	B2609	2939	V50x90	95	B.2.4.5-8	1.68	1.68	0.04	0.00	0.00
N+0.00	B2609	2939	V50x90	145	B.2.4.5-8	1.68	1.83	0.04	0.00	0.00
N+0.00	B2609	2939	V50x90	195	B.2.4.5-8	1.68	2.21	0.04	0.00	0.00
N+0.00	B2609	2939	V50x90	245	B.2.4.5-8	1.68	2.35	0.04	0.00	0.00
N+0.00	B2609	2939	V50x90	245	B.2.4.5-8	1.72	2.39	0.03	0.00	0.00
N+0.00	B2609	2939	V50x90	283	B.2.4.5-8	1.72	1.72	0.04	0.00	0.00
N+0.00	B2609	2939	V50x90	320	B.2.4.5-8	1.72	1.72	0.04	0.00	0.00
N+0.00	B2609	2939	V50x90	320	B.2.4.5-8	1.72	1.72	0.04	0.00	0.00
N+0.00	B2609	2939	V50x90	358	B.2.4.5-8	1.72	1.72	0.04	0.00	0.00
N+0.00	B2609	2939	V50x90	395	B.2.4.5-8	1.77	1.72	0.04	0.00	0.00
N+0.00	B2609	2939	V50x90	395	B.2.4.5-8	1.77	1.75	0.05	0.00	0.00
N+0.00	B2609	2939	V50x90	430	B.2.4.5-8	4.20	1.75	0.06	0.00	0.00
N+0.00	B2609	2939	V50x90	465	B.2.4.5-8	6.76	3.41	0.06	0.00	0.00
N+0.00	B2630	3299	V50x90	25	B.2.4.5-8	10.63	5.44	0.08	0.00	0.00
N+0.00	B2630	3299	V50x90	59	B.2.4.5-8	7.48	2.88	0.08	0.00	0.00
N+0.00	B2630	3299	V50x90	94	B.2.4.5-8	4.49	2.88	0.08	0.00	0.00
N+0.00	B2630	3299	V50x90	128	B.2.4.5-8	2.88	2.88	0.08	0.00	0.00
N+0.00	B2630	3299	V50x90	128	B.2.4.5-8	2.79	2.79	0.06	0.00	0.00
N+0.00	B2630	3299	V50x90	178	B.2.4.5-8	2.79	2.85	0.06	0.00	0.00
N+0.00	B2630	3299	V50x90	228	B.2.4.5-8	2.79	4.17	0.06	0.00	0.00
N+0.00	B2630	3299	V50x90	278	B.2.4.5-8	2.79	5.25	0.05	0.00	0.00
N+0.00	B2630	3299	V50x90	278	B.2.4.5-8	2.84	5.31	0.05	0.00	0.00
N+0.00	B2630	3299	V50x90	328	B.2.4.5-8	2.84	4.82	0.05	0.00	0.00
N+0.00	B2630	3299	V50x90	378	B.2.4.5-8	2.84	4.08	0.05	0.00	0.00
N+0.00	B2630	3299	V50x90	428	B.2.4.5-8	2.84	3.10	0.05	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station	As Top Combo	As Top	As Bottom	At Shear	At Torsion	At Torsion
				cm		cm ²	cm ²	cm ² /cm	cm ²	cm ² /cm
N+0.00	B2630	3299	V50x90	428	B.2.4.5-8	3.09	3.23	0.07	0.00	0.00
N+0.00	B2630	3299	V50x90	462	B.2.4.5-8	3.09	3.09	0.07	0.00	0.00
N+0.00	B2630	3299	V50x90	497	B.2.4.5-8	3.74	3.09	0.07	0.00	0.00
N+0.00	B2630	3299	V50x90	531	B.2.4.5-8	6.10	3.31	0.08	0.00	0.00
N+0.00	B29	311	V50x90	63	B.2.4.5-8	10.95	6.89	0.02	0.00	0.00
N+0.00	B29	311	V50x90	95	B.2.4.5-8	9.19	4.84	0.02	0.00	0.00
N+0.00	B29	311	V50x90	95	B.2.4.5-8	8.53	4.24	0.01	0.00	0.00
N+0.00	B29	311	V50x90	145	B.2.4.5-8	6.56	4.24	0.01	0.00	0.00
N+0.00	B29	311	V50x90	195	B.2.4.5-8	4.84	4.24	0.01	0.00	0.00
N+0.00	B29	311	V50x90	245	B.2.4.5-8	4.24	4.24	0.03	0.00	0.00
N+0.00	B29	311	V50x90	245	B.2.4.5-8	3.67	3.67	0.00	0.00	0.00
N+0.00	B29	311	V50x90	295	B.2.4.5-8	3.67	3.67	0.00	0.00	0.00
N+0.00	B29	311	V50x90	345	B.2.4.5-8	3.67	3.67	0.00	0.00	0.00
N+0.00	B29	311	V50x90	395	B.2.4.5-8	3.67	3.67	0.00	0.00	0.00
N+0.00	B29	311	V50x90	395	B.2.4.5-8	3.31	3.31	0.00	0.00	0.00
N+0.00	B29	311	V50x90	443	B.2.4.5-8	3.31	3.31	0.00	0.00	0.00
N+0.00	B29	311	V50x90	490	B.2.4.5-8	3.60	2.45	0.00	0.00	0.00
N+0.00	B30	39	V50x90	25	B.2.4.5-3	2.56	17.45	0.24	0.00	0.00
N+0.00	B30	39	V50x90	56	B.2.4.5-3	9.14	11.54	0.24	0.00	0.00
N+0.00	B30	39	V50x90	88	B.2.4.5-3	9.14	9.14	0.24	0.00	0.00
N+0.00	B30	39	V50x90	88	B.2.4.5-3	9.73	9.73	0.28	0.00	0.00
N+0.00	B30	39	V50x90	114	B.2.4.4-4	14.17	9.73	0.28	0.00	0.00
N+0.00	B30	39	V50x90	141	B.2.4.5-3	22.34	14.17	0.29	0.00	0.00
N+0.00	B32	40	V50x90	15	B.2.4.5-8	5.27	2.74	0.03	0.00	0.00
N+0.00	B32	40	V50x90	48	B.2.4.5-8	5.04	1.48	0.03	0.00	0.00
N+0.00	B32	40	V50x90	82	B.2.4.5-8	4.88	1.48	0.03	0.00	0.00
N+0.00	B32	40	V50x90	82	B.2.4.5-8	4.31	1.42	0.04	0.00	0.00
N+0.00	B32	40	V50x90	132	B.2.4.5-8	3.50	1.42	0.04	0.00	0.00
N+0.00	B32	40	V50x90	182	B.2.4.5-8	2.87	1.42	0.03	0.00	0.00
N+0.00	B32	40	V50x90	232	B.2.4.5-8	2.44	1.42	0.03	0.00	0.00
N+0.00	B32	40	V50x90	232	B.2.4.5-8	2.50	1.97	0.04	0.00	0.00
N+0.00	B32	40	V50x90	282	B.2.4.5-8	1.99	1.97	0.03	0.00	0.00
N+0.00	B32	40	V50x90	332	B.2.4.5-8	1.97	1.97	0.03	0.00	0.00
N+0.00	B32	40	V50x90	382	B.2.4.5-8	1.97	1.97	0.03	0.00	0.00
N+0.00	B32	40	V50x90	382	B.2.4.5-8	2.32	2.32	0.03	0.00	0.00
N+0.00	B32	40	V50x90	432	B.2.4.5-8	2.32	2.32	0.03	0.00	0.00
N+0.00	B32	40	V50x90	482	B.2.4.5-8	2.32	2.32	0.03	0.00	0.00
N+0.00	B32	40	V50x90	532	B.2.4.5-8	2.32	2.32	0.03	0.00	0.00
N+0.00	B32	40	V50x90	532	B.2.4.5-8	2.37	3.27	0.03	0.00	0.00
N+0.00	B32	40	V50x90	563	B.2.4.5-8	2.37	3.37	0.03	0.00	0.00
N+0.00	B32	40	V50x90	594	B.2.4.7-8	1.15	3.41	0.03	0.00	0.00
N+0.00	B56	398	V50x90	0	B.2.4.5-3	6.36	3.63	0.00	0.00	0.00
N+0.00	B56	398	V50x90	44	B.2.4.5-3	5.48	2.28	0.00	0.00	0.00
N+0.00	B56	398	V50x90	88	B.2.4.5-3	4.76	2.28	0.00	0.00	0.00
N+0.00	B56	398	V50x90	88	B.2.4.5-3	4.44	2.05	0.01	0.00	0.00
N+0.00	B56	398	V50x90	138	B.2.4.5-3	3.07	2.05	0.01	0.00	0.00
N+0.00	B56	398	V50x90	188	B.2.4.5-3	2.05	2.05	0.00	0.00	0.00
N+0.00	B56	398	V50x90	238	B.2.4.5-3	2.05	2.05	0.00	0.00	0.00
N+0.00	B56	398	V50x90	238	B.2.4.5-3	1.82	1.82	0.00	0.00	0.00
N+0.00	B56	398	V50x90	288	B.2.4.5-3	1.82	1.82	0.00	0.00	0.00
N+0.00	B56	398	V50x90	338	B.2.4.5-3	1.82	1.82	0.00	0.00	0.00
N+0.00	B56	398	V50x90	388	B.2.4.5-3	1.82	1.82	0.00	0.00	0.00
N+0.00	B56	398	V50x90	388	B.2.4.5-3	1.57	1.57	0.04	0.00	0.00
N+0.00	B56	398	V50x90	438	B.2.4.7-4	1.64	1.57	0.04	0.00	0.00
N+0.00	B56	398	V50x90	488	B.2.4.5-3	3.08	1.57	0.04	0.00	0.00
N+0.00	B56	398	V50x90	538	B.2.4.5-3	4.97	2.59	0.04	0.00	0.00
N+0.00	B57	405	V50x90	0	B.2.4.5-3	5.21	2.83	0.09	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station cm	As Top Combo	As Top cm ²	As Bottom cm ²	At Shear cm ² /cm	At Torsion cm ²	At Torsion cm ² /cm
N+0.00	B57	405	V50x90	49	B.2.4.5-8	9.72	1.75	0.09	0.00	0.00
N+0.00	B57	405	V50x90	49	B.2.4.5-8	6.50	4.59	0.04	0.00	0.00
N+0.00	B57	405	V50x90	82	B.2.4.5-8	6.42	4.59	0.04	0.00	0.00
N+0.00	B57	405	V50x90	116	B.2.4.5-8	6.44	4.59	0.04	0.00	0.00
N+0.00	B57	405	V50x90	150	B.2.4.5-8	6.57	4.59	0.04	0.00	0.00
N+0.00	B57	405	V50x90	150	B.2.4.5-3	7.71	4.74	0.04	0.00	0.00
N+0.00	B57	405	V50x90	194	B.2.4.5-3	7.94	4.74	0.04	0.00	0.00
N+0.00	B57	405	V50x90	238	B.2.4.5-3	8.30	5.90	0.04	0.00	0.00
N+0.00	B58	572	V50X60	0	B.2.4.5-8	9.17	5.18	0.19	0.00	0.00
N+0.00	B58	572	V50X60	47	B.2.4.5-8	5.57	3.14	0.18	0.00	0.00
N+0.00	B58	572	V50X60	93	B.2.4.5-8	3.14	3.14	0.18	0.00	0.00
N+0.00	B58	572	V50X60	140	B.2.4.5-8	3.14	3.45	0.18	0.00	0.00
N+0.00	B58	572	V50X60	140	B.2.4.5-8	4.50	4.63	0.17	0.00	0.00
N+0.00	B58	572	V50X60	179	B.2.4.5-8	4.50	7.21	0.17	0.00	0.00
N+0.00	B58	572	V50X60	218	B.2.4.7-8	2.93	9.17	0.16	0.00	0.00
N+0.00	B177	14	V50x90	50	B.2.4.5-8	20.99	14.17	0.13	0.00	0.00
N+0.00	B177	14	V50x90	89	B.2.4.5-8	14.46	9.35	0.13	0.00	0.00
N+0.00	B177	14	V50x90	128	B.2.4.5-8	10.94	9.35	0.13	0.00	0.00
N+0.00	B177	14	V50x90	128	B.2.4.5-8	10.39	8.65	0.04	0.00	0.00
N+0.00	B177	14	V50x90	178	B.2.4.5-8	8.65	8.65	0.04	0.00	0.00
N+0.00	B177	14	V50x90	228	B.2.4.5-8	8.65	10.45	0.04	0.00	0.00
N+0.00	B177	14	V50x90	278	B.2.4.5-8	8.65	14.17	0.04	0.00	0.00
N+0.00	B177	14	V50x90	278	B.2.4.5-8	8.14	14.17	0.00	0.00	0.00
N+0.00	B177	14	V50x90	328	B.2.4.5-8	8.14	14.17	0.00	0.00	0.00
N+0.00	B177	14	V50x90	378	B.2.4.5-8	8.14	14.19	0.00	0.00	0.00
N+0.00	B177	14	V50x90	428	B.2.4.5-8	8.14	15.60	0.00	0.00	0.00
N+0.00	B177	14	V50x90	428	B.2.4.5-8	7.81	15.46	0.00	0.00	0.00
N+0.00	B177	14	V50x90	471	B.2.4.5-8	7.81	15.90	0.00	0.00	0.00
N+0.00	B177	14	V50x90	513	B.2.4.5-8	7.81	16.21	0.00	0.00	0.00
N+0.00	B177	14	V50x90	556	B.2.4.5-8	7.81	16.39	0.00	0.00	0.00
N+0.00	B177	14	V50x90	556	B.2.4.5-8	7.48	16.16	0.00	0.00	0.00
N+0.00	B177	14	V50x90	595	B.2.4.5-8	7.48	15.25	0.00	0.00	0.00
N+0.00	B177	14	V50x90	634	B.2.4.5-8	7.48	14.24	0.00	0.00	0.00
N+0.00	B177	14	V50x90	673	B.2.4.5-8	7.48	14.17	0.00	0.00	0.00
N+0.00	B177	14	V50x90	673	B.2.4.5-8	7.36	14.17	0.00	0.00	0.00
N+0.00	B177	14	V50x90	722	B.2.4.5-8	7.36	14.17	0.00	0.00	0.00
N+0.00	B177	14	V50x90	771	B.2.4.5-8	7.36	11.71	0.00	0.00	0.00
N+0.00	B177	14	V50x90	820	B.2.4.5-8	7.36	8.55	0.00	0.00	0.00
N+0.00	B177	14	V50x90	820	B.2.4.5-8	7.62	8.47	0.02	0.00	0.00
N+0.00	B177	14	V50x90	858	B.2.4.5-8	7.62	7.62	0.02	0.00	0.00
N+0.00	B177	14	V50x90	897	B.2.4.5-8	7.62	7.62	0.02	0.00	0.00
N+0.00	B177	14	V50x90	935	B.2.4.5-8	10.03	7.62	0.02	0.00	0.00
N+0.00	B177	14	V50x90	973	B.2.4.5-8	13.65	7.62	0.03	0.00	0.00
N+0.00	B177	14	V50x90	973	B.2.4.5-8	14.17	8.21	0.04	0.00	0.00
N+0.00	B177	14	V50x90	1010	B.2.4.4-4	14.17	8.21	0.04	0.00	0.00
N+0.00	B177	14	V50x90	1046	B.2.4.5-8	16.88	12.20	0.04	0.00	0.00
N+0.00	B178	35	V50x90	25	B.2.4.5-8	0.72	2.19	0.01	0.00	0.00
N+0.00	B178	35	V50x90	56	B.2.4.5-8	1.22	2.24	0.01	0.00	0.00
N+0.00	B178	35	V50x90	88	B.2.4.5-8	1.22	2.20	0.01	0.00	0.00
N+0.00	B178	35	V50x90	88	B.2.4.5-8	1.19	1.19	0.02	0.00	0.00
N+0.00	B178	35	V50x90	138	B.2.4.5-8	1.19	1.71	0.02	0.00	0.00
N+0.00	B178	35	V50x90	188	B.2.4.5-8	1.19	2.08	0.01	0.00	0.00
N+0.00	B178	35	V50x90	238	B.2.4.5-8	1.19	2.21	0.01	0.00	0.00
N+0.00	B178	35	V50x90	238	B.2.4.5-8	1.21	1.29	0.02	0.00	0.00
N+0.00	B178	35	V50x90	288	B.2.4.5-8	1.21	1.67	0.02	0.00	0.00
N+0.00	B178	35	V50x90	338	B.2.4.5-8	1.21	1.81	0.01	0.00	0.00
N+0.00	B178	35	V50x90	388	B.2.4.5-8	1.21	1.72	0.01	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station	As Top Combo	As Top	As Bottom	At Shear	At Torsion	At Torsion
				cm		cm ²	cm ²	cm ² /cm	cm ²	cm ² /cm
N+0.00	B178	35	V50x90	388	B.2.4.5-8	1.31	1.46	0.01	0.00	0.00
N+0.00	B178	35	V50x90	438	B.2.4.5-8	1.31	1.41	0.01	0.00	0.00
N+0.00	B178	35	V50x90	488	B.2.4.5-8	1.31	1.31	0.02	0.00	0.00
N+0.00	B178	35	V50x90	538	B.2.4.5-8	1.31	1.31	0.02	0.00	0.00
N+0.00	B178	35	V50x90	538	B.2.4.5-8	1.49	1.49	0.01	0.00	0.00
N+0.00	B178	35	V50x90	588	B.2.4.5-8	1.60	1.49	0.02	0.00	0.00
N+0.00	B178	35	V50x90	638	B.2.4.5-8	2.31	1.49	0.02	0.00	0.00
N+0.00	B178	35	V50x90	688	B.2.4.5-8	3.23	1.49	0.02	0.00	0.00
N+0.00	B178	35	V50x90	688	B.2.4.5-8	2.81	1.57	0.01	0.00	0.00
N+0.00	B178	35	V50x90	719	B.2.4.5-8	2.88	1.57	0.01	0.00	0.00
N+0.00	B178	35	V50x90	750	B.2.4.5-8	3.03	2.08	0.02	0.00	0.00
N+0.00	B230	47	V50x90	25	B.2.4.5-3	3.37	2.46	0.02	0.00	0.00
N+0.00	B230	47	V50x90	56	B.2.4.5-3	3.20	2.20	0.02	0.00	0.00
N+0.00	B230	47	V50x90	88	B.2.4.5-3	3.11	2.20	0.02	0.00	0.00
N+0.00	B230	47	V50x90	88	B.2.4.5-8	3.53	2.09	0.03	0.00	0.00
N+0.00	B230	47	V50x90	138	B.2.4.5-8	2.47	2.09	0.03	0.00	0.00
N+0.00	B230	47	V50x90	188	B.2.4.5-8	2.09	2.09	0.02	0.00	0.00
N+0.00	B230	47	V50x90	238	B.2.4.5-8	2.09	2.30	0.02	0.00	0.00
N+0.00	B230	47	V50x90	238	B.2.4.5-8	1.93	1.93	0.02	0.00	0.00
N+0.00	B230	47	V50x90	288	B.2.4.5-8	1.93	2.20	0.02	0.00	0.00
N+0.00	B230	47	V50x90	338	B.2.4.5-8	1.93	2.58	0.02	0.00	0.00
N+0.00	B230	47	V50x90	388	B.2.4.5-8	1.93	2.74	0.02	0.00	0.00
N+0.00	B230	47	V50x90	388	B.2.4.5-8	1.82	2.99	0.02	0.00	0.00
N+0.00	B230	47	V50x90	438	B.2.4.5-8	1.82	3.12	0.02	0.00	0.00
N+0.00	B230	47	V50x90	488	B.2.4.5-8	1.82	3.01	0.02	0.00	0.00
N+0.00	B230	47	V50x90	538	B.2.4.5-8	1.82	2.66	0.02	0.00	0.00
N+0.00	B230	47	V50x90	538	B.2.4.5-8	1.75	3.64	0.02	0.00	0.00
N+0.00	B230	47	V50x90	588	B.2.4.5-8	1.75	3.47	0.02	0.00	0.00
N+0.00	B230	47	V50x90	638	B.2.4.5-8	1.75	3.06	0.02	0.00	0.00
N+0.00	B230	47	V50x90	688	B.2.4.5-8	1.75	2.42	0.03	0.00	0.00
N+0.00	B230	47	V50x90	688	B.2.4.5-8	1.78	3.65	0.02	0.00	0.00
N+0.00	B230	47	V50x90	719	B.2.4.5-8	1.78	3.68	0.02	0.00	0.00
N+0.00	B230	47	V50x90	750	B.2.4.5-8	1.14	3.62	0.02	0.00	0.00
N+0.00	B231	48	V50x90	50	B.2.4.5-8	19.24	13.88	0.11	0.00	0.00
N+0.00	B231	48	V50x90	89	B.2.4.2-2	14.17	8.15	0.11	0.00	0.00
N+0.00	B231	48	V50x90	128	B.2.4.5-8	10.12	8.15	0.11	0.00	0.00
N+0.00	B231	48	V50x90	128	B.2.4.5-8	9.88	7.78	0.03	0.00	0.00
N+0.00	B231	48	V50x90	178	B.2.4.5-8	7.78	7.78	0.02	0.00	0.00
N+0.00	B231	48	V50x90	228	B.2.4.5-8	7.78	9.64	0.02	0.00	0.00
N+0.00	B231	48	V50x90	278	B.2.4.5-8	7.78	13.68	0.02	0.00	0.00
N+0.00	B231	48	V50x90	278	B.2.4.5-8	7.51	13.50	0.00	0.00	0.00
N+0.00	B231	48	V50x90	328	B.2.4.5-8	7.51	14.17	0.00	0.00	0.00
N+0.00	B231	48	V50x90	378	B.2.4.5-8	7.51	14.17	0.00	0.00	0.00
N+0.00	B231	48	V50x90	428	B.2.4.5-8	7.51	14.43	0.00	0.00	0.00
N+0.00	B231	48	V50x90	428	B.2.4.5-8	7.38	14.40	0.00	0.00	0.00
N+0.00	B231	48	V50x90	471	B.2.4.5-8	7.38	14.79	0.00	0.00	0.00
N+0.00	B231	48	V50x90	513	B.2.4.5-8	7.38	15.05	0.00	0.00	0.00
N+0.00	B231	48	V50x90	556	B.2.4.5-8	7.38	15.18	0.00	0.00	0.00
N+0.00	B231	48	V50x90	556	B.2.4.5-8	7.29	15.25	0.00	0.00	0.00
N+0.00	B231	48	V50x90	595	B.2.4.5-8	7.29	14.46	0.00	0.00	0.00
N+0.00	B231	48	V50x90	634	B.2.4.5-8	7.29	14.17	0.00	0.00	0.00
N+0.00	B231	48	V50x90	673	B.2.4.5-8	7.29	14.17	0.00	0.00	0.00
N+0.00	B231	48	V50x90	673	B.2.4.5-8	7.45	14.17	0.00	0.00	0.00
N+0.00	B231	48	V50x90	722	B.2.4.5-8	7.45	14.17	0.00	0.00	0.00
N+0.00	B231	48	V50x90	771	B.2.4.5-8	7.45	11.58	0.00	0.00	0.00
N+0.00	B231	48	V50x90	820	B.2.4.5-8	7.45	8.57	0.00	0.00	0.00
N+0.00	B231	48	V50x90	820	B.2.4.5-8	8.04	8.93	0.02	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

Story	Label	Unique Name	Design Section	Station cm	As Top Combo	As Top cm ²	As Bottom cm ²	At Shear cm ² /cm	At Torsion cm ²	At Torsion cm ² /cm
N+0.00	B231	48	V50x90	858	B.2.4.5-8	8.04	8.04	0.02	0.00	0.00
N+0.00	B231	48	V50x90	897	B.2.4.5-8	8.04	8.04	0.02	0.00	0.00
N+0.00	B231	48	V50x90	935	B.2.4.5-8	10.27	8.04	0.03	0.00	0.00
N+0.00	B231	48	V50x90	973	B.2.4.5-8	14.11	8.04	0.03	0.00	0.00
N+0.00	B231	48	V50x90	973	B.2.4.5-8	14.17	8.91	0.07	0.00	0.00
N+0.00	B231	48	V50x90	1010	B.2.4.5-8	15.30	8.91	0.07	0.00	0.00
N+0.00	B231	48	V50x90	1046	B.2.4.5-8	19.56	14.17	0.07	0.00	0.00
N+0.00	B232	49	V50x90	25	B.2.4.5-8	8.80	5.31	0.11	12.98	0.05
N+0.00	B232	49	V50x90	67	B.2.4.5-8	6.64	3.58	0.11	12.98	0.05
N+0.00	B232	49	V50x90	108	B.2.4.5-8	4.67	3.58	0.10	12.98	0.05
N+0.00	B232	49	V50x90	150	B.2.4.5-8	3.58	3.58	0.10	12.98	0.05
N+0.00	B232	49	V50x90	150	B.2.4.5-8	2.35	2.35	0.08	0.00	0.00
N+0.00	B232	49	V50x90	200	B.2.4.5-8	2.35	2.35	0.08	0.00	0.00
N+0.00	B232	49	V50x90	249	B.2.4.5-8	2.35	2.35	0.07	0.00	0.00
N+0.00	B232	49	V50x90	299	B.2.4.5-8	2.35	2.35	0.07	0.00	0.00
N+0.00	B232	49	V50x90	299	B.2.4.5-3	1.33	1.33	0.08	0.00	0.00
N+0.00	B232	49	V50x90	349	B.2.4.5-3	1.33	1.33	0.09	0.00	0.00
N+0.00	B232	49	V50x90	399	B.2.4.5-3	1.33	1.33	0.09	0.00	0.00
N+0.00	B232	49	V50x90	449	B.2.4.5-8	2.51	1.33	0.09	0.00	0.00
N+0.00	B232	49	V50x90	449	B.2.4.5-3	2.30	2.30	0.08	0.00	0.00
N+0.00	B232	49	V50x90	492	B.2.4.5-3	2.30	2.30	0.07	0.00	0.00
N+0.00	B232	49	V50x90	536	B.2.4.5-3	2.30	2.30	0.07	0.00	0.00
N+0.00	B232	49	V50x90	579	B.2.4.5-3	2.30	2.30	0.07	0.00	0.00
N+0.00	B232	49	V50x90	579	B.2.4.5-3	2.03	2.04	0.07	0.00	0.00
N+0.00	B232	49	V50x90	619	B.2.4.5-3	2.03	2.40	0.07	0.00	0.00
N+0.00	B232	49	V50x90	659	B.2.4.7-4	2.09	2.67	0.07	0.00	0.00
N+0.00	B235	2314	V50x90	15	B.2.4.7-8	0.61	1.39	0.03	0.00	0.00
N+0.00	B235	2314	V50x90	62	B.2.4.5-8	1.24	1.33	0.03	0.00	0.00
N+0.00	B235	2314	V50x90	110	B.2.4.5-8	1.24	1.24	0.04	0.00	0.00
N+0.00	B235	2314	V50x90	157	B.2.4.5-8	1.24	1.24	0.04	0.00	0.00
N+0.00	B235	2314	V50x90	157	B.2.4.5-8	2.70	1.81	0.03	0.00	0.00
N+0.00	B235	2314	V50x90	201	B.2.4.5-8	2.88	1.81	0.04	0.00	0.00
N+0.00	B235	2314	V50x90	245	B.2.4.5-8	3.24	1.81	0.04	0.00	0.00
N+0.00	B235	2314	V50x90	289	B.2.4.5-8	3.79	2.49	0.04	0.00	0.00
N+0.00	B236	2342	V30X90	25	B.2.4.5-8	1.96	1.46	0.02	0.00	0.00
N+0.00	B236	2342	V30X90	59	B.2.4.5-8	1.83	1.21	0.01	0.00	0.00
N+0.00	B236	2342	V30X90	94	B.2.4.5-8	1.79	1.21	0.01	0.00	0.00
N+0.00	B236	2342	V30X90	128	B.2.4.5-8	1.83	1.21	0.01	0.00	0.00
N+0.00	B236	2342	V30X90	128	B.2.4.5-3	1.51	0.97	0.02	0.00	0.00
N+0.00	B236	2342	V30X90	178	B.2.4.5-3	1.19	0.97	0.02	0.00	0.00
N+0.00	B236	2342	V30X90	228	B.2.4.5-3	1.06	0.97	0.01	0.00	0.00
N+0.00	B236	2342	V30X90	278	B.2.4.5-3	1.13	0.97	0.02	0.00	0.00
N+0.00	B236	2342	V30X90	278	B.2.4.5-3	0.81	0.79	0.02	0.00	0.00
N+0.00	B236	2342	V30X90	328	B.2.4.5-3	0.79	0.79	0.01	0.00	0.00
N+0.00	B236	2342	V30X90	378	B.2.4.5-3	0.79	0.79	0.01	0.00	0.00
N+0.00	B236	2342	V30X90	428	B.2.4.5-3	0.95	0.79	0.02	0.00	0.00
N+0.00	B236	2342	V30X90	428	B.2.4.5-8	0.97	0.97	0.02	0.00	0.00
N+0.00	B236	2342	V30X90	471	B.2.4.5-8	0.97	0.97	0.01	0.00	0.00
N+0.00	B236	2342	V30X90	513	B.2.4.5-8	0.97	0.97	0.01	0.00	0.00
N+0.00	B236	2342	V30X90	556	B.2.4.5-8	1.02	0.97	0.02	0.00	0.00
N+0.00	B236	2342	V30X90	556	B.2.4.7-8	0.76	0.63	0.02	0.00	0.00
N+0.00	B236	2342	V30X90	595	B.2.4.7-8	0.64	0.63	0.01	0.00	0.00
N+0.00	B236	2342	V30X90	634	B.2.4.7-8	0.63	0.63	0.01	0.00	0.00
N+0.00	B236	2342	V30X90	673	B.2.4.7-8	0.63	0.63	0.01	0.00	0.00
N+0.00	B236	2342	V30X90	673	B.2.4.7-8	0.41	0.41	0.02	0.00	0.00
N+0.00	B236	2342	V30X90	722	B.2.4.7-8	0.41	0.41	0.02	0.00	0.00
N+0.00	B236	2342	V30X90	771	B.2.4.7-8	0.41	0.47	0.01	0.00	0.00

TABLE: Concrete Beam Summary - ACI 318-14

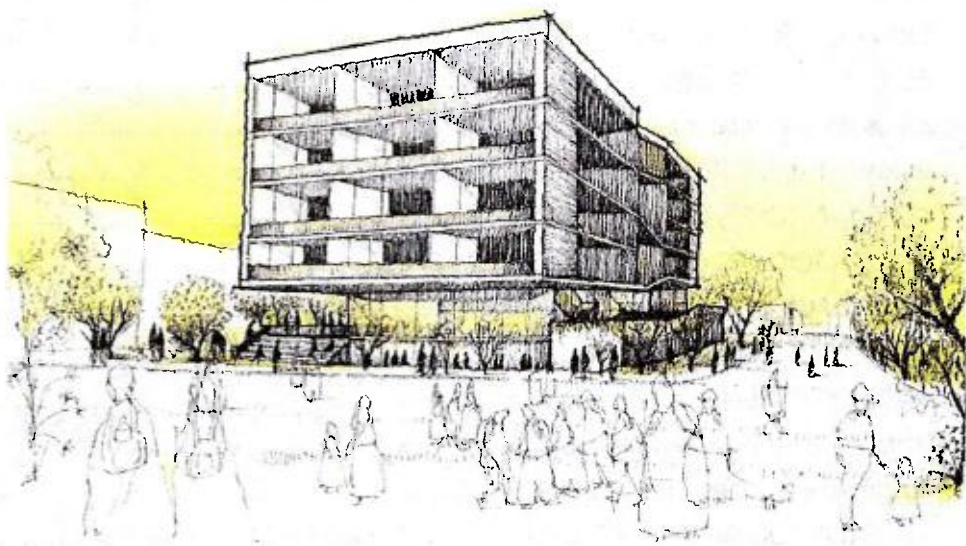
Story	Label	Unique Name	Design Section	Station	As Top Combo	As Top	As Bottom	At Shear	At Torsion	At Torsion
				cm		cm ²	cm ²	cm ² /cm	cm ²	cm ² /cm
N+0.00	B236	2342	V30X90	820	B.2.4.7-8	0.41	0.41	0.01	0.00	0.00
N+0.00	B236	2342	V30X90	820	B.2.4.7-4	0.10	0.20	0.02	0.00	0.00
N+0.00	B236	2342	V30X90	858	B.2.4.7-4	0.10	0.36	0.01	0.00	0.00
N+0.00	B236	2342	V30X90	897	B.2.4.7-4	0.10	0.43	0.01	0.00	0.00
N+0.00	B236	2342	V30X90	935	B.2.4.7-4	0.10	0.37	0.02	0.00	0.00
N+0.00	B236	2342	V30X90	973	B.2.4.7-4	0.10	0.22	0.02	0.00	0.00
N+0.00	B236	2342	V30X90	973	B.2.4.7-8	0.14	0.51	0.02	0.00	0.00
N+0.00	B236	2342	V30X90	1022	B.2.4.7-8	0.14	0.64	0.01	0.00	0.00
N+0.00	B236	2342	V30X90	1071	B.2.4.4-4	0.00	0.60	0.01	0.00	0.00
N+0.00	B237	165	V50x90	50	B.2.4.5-3	2.87	2.49	0.03	0.00	0.00
N+0.00	B237	165	V50x90	84	B.2.4.7-4	2.50	2.35	0.03	0.00	0.00
N+0.00	B237	165	V50x90	117	B.2.4.7-4	2.21	2.14	0.03	0.00	0.00
N+0.00	B237	165	V50x90	151	B.2.4.7-4	2.00	1.86	0.03	0.00	0.00
N+0.00	B237	165	V50x90	151	B.2.4.7-4	0.98	0.98	0.04	0.00	0.00
N+0.00	B237	165	V50x90	189	B.2.4.7-4	0.98	0.98	0.03	0.00	0.00
N+0.00	B237	165	V50x90	227	B.2.4.7-4	0.98	0.98	0.03	0.00	0.00
N+0.00	B237	165	V50x90	264	B.2.4.7-4	0.98	1.11	0.03	0.00	0.00
N+0.00	B237	165	V50x90	302	B.2.4.7-4	0.98	1.29	0.03	0.00	0.00
N+0.00	B237	165	V50x90	302	B.2.4.7-4	1.30	2.18	0.03	0.00	0.00
N+0.00	B237	165	V50x90	336	B.2.4.7-4	1.42	2.61	0.03	0.00	0.00
N+0.00	B237	165	V50x90	369	B.2.4.7-4	1.61	2.93	0.03	0.00	0.00
N+0.00	B237	165	V50x90	403	B.2.4.7-4	1.87	3.14	0.03	0.00	0.00
N+0.00	B238	166	V50x90	25	B.2.4.5-8	2.34	2.03	0.02	0.00	0.00
N+0.00	B238	166	V50x90	71	B.2.4.5-8	2.08	2.06	0.02	0.00	0.00
N+0.00	B238	166	V50x90	117	B.2.4.5-8	2.01	1.93	0.02	0.00	0.00
N+0.00	B238	166	V50x90	117	B.2.4.5-8	1.40	1.26	0.02	0.00	0.00
N+0.00	B238	166	V50x90	166	B.2.4.5-8	1.26	1.49	0.02	0.00	0.00
N+0.00	B238	166	V50x90	215	B.2.4.5-8	1.26	1.49	0.02	0.00	0.00
N+0.00	B238	166	V50x90	264	B.2.4.5-8	1.26	1.27	0.02	0.00	0.00
N+0.00	B238	166	V50x90	264	B.2.4.5-8	0.84	1.15	0.02	0.00	0.00
N+0.00	B238	166	V50x90	302	B.2.4.5-8	0.84	1.42	0.02	0.00	0.00
N+0.00	B238	166	V50x90	341	B.2.4.5-8	0.84	1.56	0.02	0.00	0.00
N+0.00	B238	166	V50x90	379	B.2.4.5-8	0.84	1.55	0.02	0.00	0.00
N+0.00	B238	166	V50x90	417	B.2.4.7-8	1.06	1.41	0.02	0.00	0.00
N+0.00	B238	166	V50x90	417	B.2.4.7-8	0.96	1.70	0.02	0.00	0.00
N+0.00	B238	166	V50x90	466	B.2.4.7-8	0.99	1.93	0.01	0.00	0.00
N+0.00	B238	166	V50x90	515	B.2.4.7-8	1.18	1.92	0.02	0.00	0.00
N+0.00	B240	1996	V50x90	50	B.2.4.5-8	7.33	7.07	0.10	0.00	0.00
N+0.00	B240	1996	V50x90	84	B.2.4.7-8	4.75	6.61	0.10	0.00	0.00
N+0.00	B240	1996	V50x90	117	B.2.4.5-8	3.11	6.39	0.10	0.00	0.00
N+0.00	B240	1996	V50x90	117	B.2.4.5-8	2.65	5.87	0.08	0.00	0.00
N+0.00	B240	1996	V50x90	166	B.2.4.5-8	2.65	5.12	0.08	0.00	0.00
N+0.00	B240	1996	V50x90	215	B.2.4.5-8	2.65	4.16	0.07	0.00	0.00
N+0.00	B240	1996	V50x90	264	B.2.4.5-8	2.65	3.90	0.07	0.00	0.00
N+0.00	B240	1996	V50x90	264	B.2.4.5-8	3.55	4.73	0.08	0.00	0.00
N+0.00	B240	1996	V50x90	302	B.2.4.5-8	3.55	4.89	0.08	0.00	0.00
N+0.00	B240	1996	V50x90	341	B.2.4.5-8	3.55	4.93	0.09	0.00	0.00
N+0.00	B240	1996	V50x90	379	B.2.4.7-8	3.73	4.83	0.09	0.00	0.00
N+0.00	B240	1996	V50x90	417	B.2.4.5-8	5.31	4.60	0.09	0.00	0.00
N+0.00	B240	1996	V50x90	417	B.2.4.5-8	6.26	5.51	0.11	0.00	0.00
N+0.00	B240	1996	V50x90	454	B.2.4.5-8	8.75	5.28	0.11	0.00	0.00
N+0.00	B240	1996	V50x90	490	B.2.4.5-8	11.37	6.77	0.11	0.00	0.00
N+0.00	B257	3300	V50x90	25	B.2.4.5-8	6.35	3.34	0.07	0.00	0.00
N+0.00	B257	3300	V50x90	71	B.2.4.5-8	2.66	3.26	0.07	0.00	0.00
N+0.00	B257	3300	V50x90	117	B.2.4.5-8	2.51	4.63	0.07	0.00	0.00

Anexo 9.2 Rampas Metalicas Colegio Boita



ALCALDÍA MAYOR DE BOGOTÁ D.C.
SECRETARIA DE EDUCACIÓN
SUBSECRETARIA DE ACCESO Y PERMANENCIA
DIRECCIÓN DE CONSTRUCCIÓN Y CONSERVACIÓN DE ESTABLECIMIENTOS EDUCATIVOS

PROYECTO: COLEGIO BOITÁ
CONTRATO DE CONSULTORÍA 519 DE 27/12/2019



CONSULTOR: MC CONSTRUCCIONES Y CONSULTORÍAS SAS



CONTENIDO: **RAMPAS METÁLICAS MEMORIA ESTRUCTURAL**
ELABORADA POR: ING. WILLIAM JAVIER FAJARDO KUDEYRO
M.P. 7620282260 VLL

NOVIEMBRE 2020

TABLA DE CONTENIDO

	Pág.
1. FORMULACIÓN DEL PROYECTO.....	7
4.2 OBJETIVOS	7
General	7
Específicos	7
4.3 DESCRIPCIÓN DEL PROYECTO.....	7
2. ESPECIFICACIÓN DE LOS MATERIALES	10
3. DEFINICIÓN DE CARGAS DE DISEÑO	11
4. ANÁLISIS SÍSMICO.....	22
4.1 ZONA DE AMENAZA SÍSMICA DE ACUERDO CON LA MICROZONA SÍSMICA	22
4.2 COEFICIENTE DE IMPORTANCIA.....	24
4.3 TIPO DE PERFIL DE SUELO.....	26
4.4 ESPECTRO DE DISEÑO.....	27
Espectros de elásticos de aceleración	27
4.5 PARÁMETROS Y REQUISITOS DE DISEÑO.....	31
4.6 COMBINACIONES DE SERVICIO	32
4.7 COMBINACIONES DE DISEÑO.....	33
4.8 VERIFICACIÓN DE DEFLEXIONES.....	34
Verificación deflexiones rampa tipo 1	34
Verificación deflexiones rampa tipo 2	35
Verificación deflexiones rampa tipo 3	36
Verificación deflexiones rampa tipo 4	37
4.9 VERIFICACIÓN DE VIBRACIONES EN EL TABLERO DE LAS PASARELAS	37
Verificación vibraciones rampa tipo 1	39
Verificación vibraciones rampa tipo 2 y tipo 3	45
5. DISEÑO ESTRUCTURAL	53
6.1 DISEÑO DE APOYOS DE CONCRETO REGIONES D	54
Diseño de ménsulas cortas en vigas de anclaje de rampas	56
Diseño de ménsulas cortas en columnas de anclaje de rampas	70
6.2 DISEÑO DE ESTRUCTURA METALICA.....	87
6.3 DISEÑO CONEXIONES DE ESTRUCTURA METALICA	105
Diseño anclaje en ménsula.....	105
Diseño conexiones	112

LISTA DE FIGURAS

	Pág.
Figura 1 Modelo Estructural rampa tipo 1.....	8
Figura 2 Modelo Estructural rampa tipo 2.....	8
Figura 3 Modelo Estructural rampa tipo 3.....	9
Figura 4 Modelo Estructural rampa tipo 4.....	9
Figura 5 Modelo BIM estructural rampas.....	10
Figura 6 aplicación carga viva rampa tipo 1.....	19
Figura 7 aplicación carga viva barandas rampa tipo 1.....	19
Figura 8 aplicación carga muerta barandas rampa tipo 1.....	20
Figura 9 aplicación carga viva rampa tipo 2 y 3.....	20
Figura 10 aplicación carga viva barandas rampa tipo 2 y 3.....	21
Figura 11 aplicación carga muerta rampa tipo 2 y 3.....	21
Figura 12 aplicación carga viva rampa tipo 4.....	22
Figura 13 Localización del Proyecto en Mapa de Microzonificación Bogotá D.C.....	23
Figura 14 Localización a más de 200m de la Mircozona Aluvial-100.....	23
Figura 15 Zona de respuesta sísmica Aluvial-200.....	24
Figura 16 Curva de diseño para un coeficiente de amortiguamiento ξ de 5%.....	27
Figura 17 Espectro elástico de diseño $i=1.25$	28
Figura 18 Espectro elástico de aceleración $I=1.0$	29
Figura 19 Aceleración sísmica horizontal del elemento no estructural.....	30
Figura 20 Limite de deflexiones puentes peatonales.....	34
Figura 21 Deflexión carga viva rampa 1 -3.4 cm.	34
Figura 22 Deflexión carga viva rampa 2 -3.02 cm.	35
Figura 23 Deflexión carga viva rampa 3 -2.41 cm.	36
Figura 24 Deflexión carga viva rampa 3 -2.41 cm.	37
Figura 25 criterio de aceptación de la aceleración.....	38
Figura 26 criterio de aceptación de la aceleración rampa 1 dentro del limite.....	44
Figura 27 parámetros para verificación de vibración software de diseño.....	50
Figura 28 criterio de aceptación de la aceleración rampa 2 y 3 dentro del limite.....	51
Figura 29 reporte diseño servicio por vibraciones y deflexión rampa tipo 2.....	51
Figura 30 reporte diseño servicio por vibraciones y deflexión rampa tipo 3.....	52
Figura 31 reporte diseño servicio por vibraciones y deflexión rampa tipo 4.....	52
Figura 32 detalle viga ménsula.....	56
Figura 33 detalle ménsulas cortas columnas.....	70
Figura 34 tipología estructural de las rampas.....	89
Figura 35 índices de sobre esfuerzo rampa tipo 1.....	89
Figura 36 índices de sobre esfuerzo rampa tipo 2.....	92
Figura 37 índices de sobre esfuerzo rampa tipo 3.....	95
Figura 38 índices de sobre esfuerzo rampa tipo 4.....	99
Figura 39 Detalle anclaje en ménsula.....	105
Figura 40 Detalle anclaje rampa 4.....	108

Lista de Tablas

	Pág.
Tabla 1 Parámetros A_o , F_a y F_v para espectro de diseño $T_r=475$ años	27
Tabla 2 Parámetros de sitio Zona Aluvial-200	28
Tabla 3 valores recomendados de aceleración límite	38
Tabla 4 índices sobre esfuerzo rampa tipo 1	90
Tabla 5 índices sobre esfuerzo rampa tipo 2	92
Tabla 6 diseño viga compuesta rampa tipo 2	94
Tabla 7 índices sobre esfuerzo rampa tipo 3	95
Tabla 8 diseño viga compuesta rampa tipo 3	97
Tabla 9 índices sobre esfuerzo rampa tipo 4	99

CONTROL DE CAMBIOS Y DISTRIBUCIÓN DEL DOCUMENTO

Versión	Fecha	Descripción del cambio
V.0	14/08/2020	Memoria de Calculo Estructural

MC CONSTRUCCIONES Y CONSULTORÍAS SAS

ALCALDÍA MAYOR DE BOGOTÁ D.C.
SECRETARÍA DE EDUCACIÓN
SUBSECRETARÍA DE ACCESO Y PERMANENCIA
DIRECCIÓN DE CONSTRUCCIÓN Y CONSERVACIÓN DE ESTABLECIMIENTOS EDUCATIVOS

PROYECTO: COLEGIO BOITÁ
CONTRATO DE CONSULTORÍA 519 DE 27/12/2019

RAMPAS METÁLICAS MEMORIA ESTRUCTURAL

DISEÑO Y CALCULO ESTRUCTURAL
ING. WILLIAM JAVIER FAJARDO K. MSc

SANTIAGO DE CALI
AGOSTO DE 2020

1. FORMULACIÓN DEL PROYECTO

4.2 OBJETIVOS

General

Realizar el diseño de los elementos no estructurales de las rampas metálicas peatonales del edificio de la Institución Educativa Boitá Kennedy, de acuerdo con los requerimientos presentes en la Norma Colombiana Sismorresistente vigente NSR-10.

Específicos

- Reconocer y verificar la alternativa de sistema Estructural
- Especificar los materiales a utilizar.
- Determinar las solicitaciones y casos de carga más desfavorables actuantes en los elementos estructurales.
- Realizar análisis dinámico de la estructura según título A.8
- Realizar el diseño estructural

4.3 DESCRIPCIÓN DEL PROYECTO

El proyecto consiste en un edificio educativo localizado en la ciudad de Bogotá D.C. el cual está conformado por 2 edificaciones independientes estructuralmente tanto en cimentación como en altura; cada uno cuenta con 5 niveles y un sótano, se proyecta el uso de las terrazas como zonas recreativas entre estos dos edificios existen pasarelas peatonales de conexión.

El diseño de las rampas se realizará de acuerdo con lo establecido en el título A.8 para el diseño sísmico sobre elementos estructurales que no hacen parte del sistema de resistencia sísmica. Se aplicarán todos los requisitos presentes en el Reglamento NSR-10

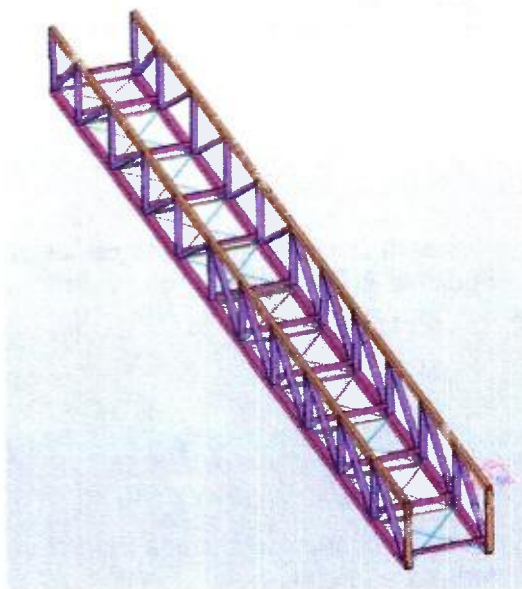


Figura 1 Modelo Estructural rampa tipo 1

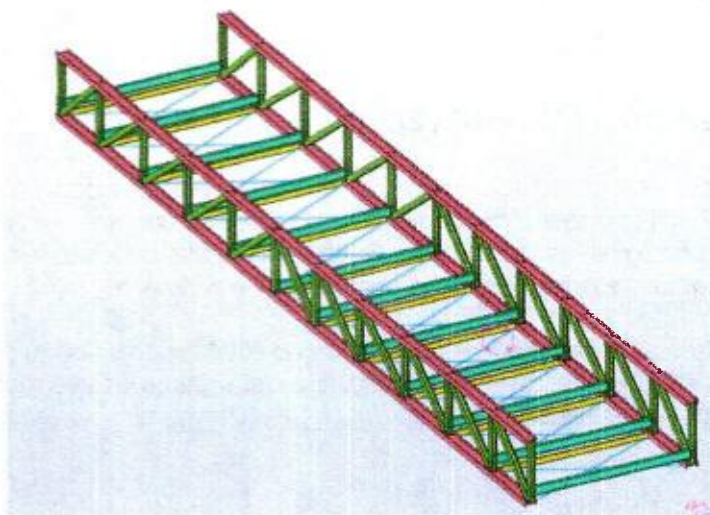


Figura 2 Modelo Estructural rampa tipo 2

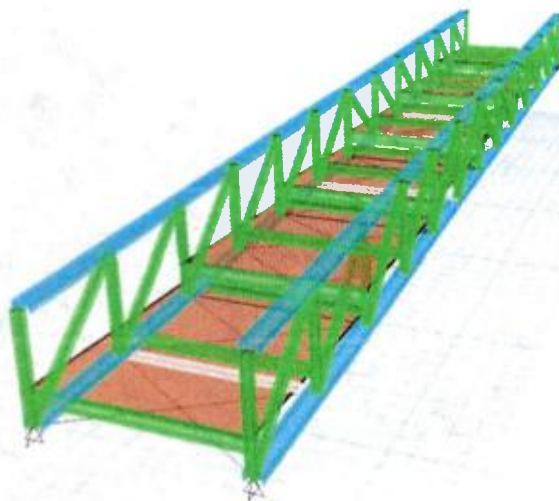


Figura 3 Modelo Estructural rampa tipo 3

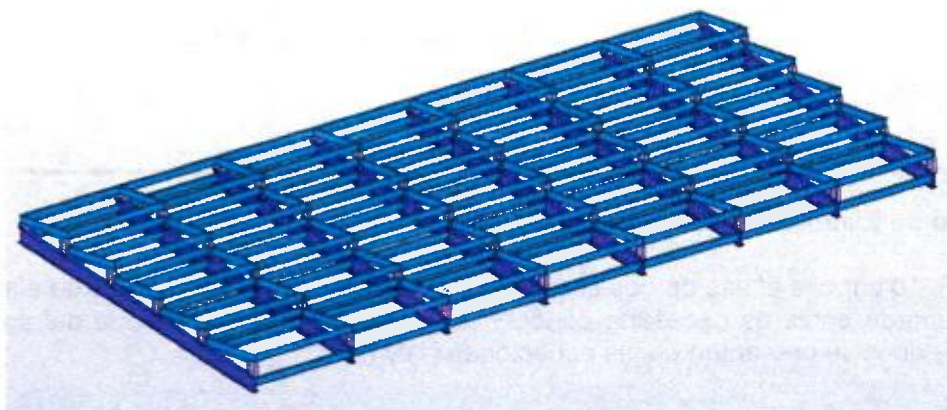


Figura 4 Modelo Estructural rampa tipo 4

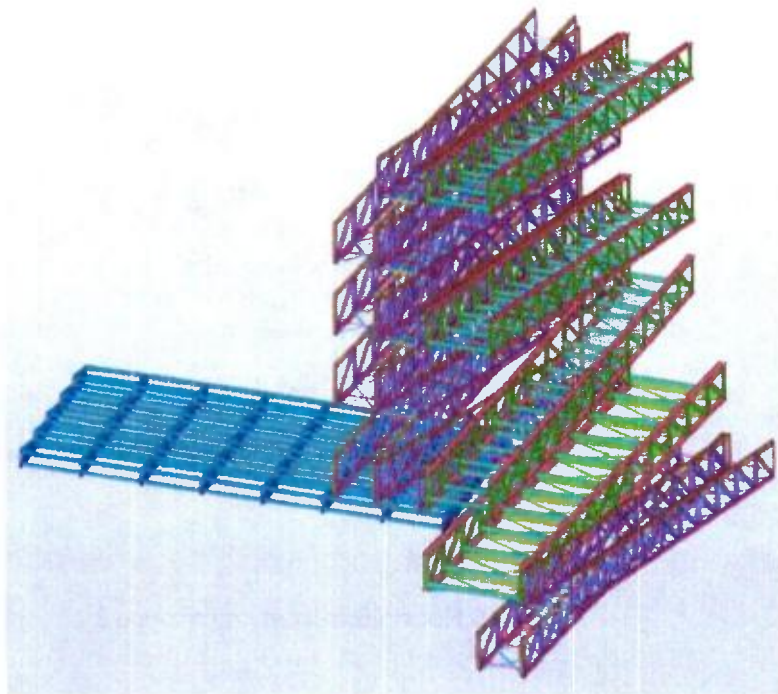


Figura 5 Modelo BIM estructural rampas

2. ESPECIFICACIÓN DE LOS MATERIALES

Módulo de Elasticidad del Concreto

La NSR-10 permite el uso de dos correlaciones para el cálculo del módulo de elasticidad, para la aplicación de estas es necesario conocer la resistencia y masa unitaria del concreto. Dichas correlaciones se presentan en las ecuaciones (1) y (2).

$$E_c = 4700\sqrt{f'_c} \quad (1)$$

$$E_c = W_c^{1.5} 0,043 \sqrt{f'_c} \quad (2)$$

Dónde:

f'_c = Resistencia del concreto en (MPa)

W_c = Masa unitario (kg/m^3)

Una vez obtenido el módulo de elasticidad por medio de las ecuaciones (1) y (2), se procede a determinar los valores promedios teniendo en cuenta la situación más crítica, la cual se presenta con la ecuación (1).

Columnas, vigas aéreas, y losas de entrepiso y Muros Pantallas:

$f'c = 27,58 \text{ MPa}, 4000\text{psi}$

$E = 4700 \sqrt{f'c}$ (Cap. C,8,5, NSR-10) $E_c = 24855 \text{ MPa}$.

Peso Unitario = 24 kN/m^3

Relación de Poisson = 0.2

Acero de Refuerzo:

Acero Grado 60 Corrugado, (A615Gr60)

$f_y = 420 \text{ MPa}$ Diámetro $> 3/8"$, $f_y = 250 \text{ MPa}$ Diámetro $1/4"$ y $3/8"$

Perfiles Metálicos y láminas metálicas:

Perfiles Tubulares y Perlines cubierta A500GrB, $F_y = 320 \text{ MPa}$ y $F_u = 400 \text{ MPa}$

Laminas metálicas ASTM A572Gr50, $F_y = 344 \text{ MPa}$ y $F_u = 448 \text{ MPa}$

Pernos A325, $F_u = 825 \text{ MPa}$

Módulo de Elasticidad 200 GPa

Peso Unitario = 76.97 kN/m^3

3. DEFINICIÓN DE CARGAS DE DISEÑO

En este ítem se especifican las cargas consideradas en la modelación tridimensional de la estructura, así como las propiedades de los materiales que se usarán en el diseño de los diferentes elementos estructurales.

La Norma Colombiana de Sismo Resistencia define en el Título B todos los lineamientos en cuanto a las cargas que se deben considerar en la modelación de una estructura, entre ellas se encuentra la Carga Muerta, Carga Viva y Fuerzas de Viento.

B.3.1 — La carga muerta cubre todas las cargas de elementos permanentes de construcción incluyendo su estructura, los muros, pisos, cubiertas, cielos rasos, escaleras, equipos fijos todas aquellas cargas que no son causadas por la ocupación y uso de la edificación. Las fuerzas netas de preesfuerzo deben incluirse dentro de la carga muerta.

B.4.1.1 — Las cargas vivas son aquellas cargas producidas por el uso y ocupación de la edificación y no deben incluir cargas ambientales tales como viento y sismo.

B.4.2.1 — Las cargas que se utilicen en el diseño de la estructura deben ser las máximas que se espera ocurran en la edificación debido al uso que ésta va a tener. En ningún caso estas cargas vivas pueden ser menores que las cargas vivas mínimas que se dan en las tablas B.4.2.1-1 y B.4.2.1-2.

EVALUACIÓN DE CARGAS VIVAS Y MUERTAS

Según la información arquitectónica, la estructura cuenta con diferentes niveles y espacios educativos. De acuerdo con el documento **Lineamiento Básicos de Construcción de Edificaciones de Construcciones Escolares 2017**, en el Capítulo 6. **Especificaciones Básicas de Construcción**, definido por la Secretaria de Educación Distrital de la Ciudad de Bogotá D.C, en el. Se tuvieron en cuenta los siguientes cuadros de especificaciones:

DEPENDENCIA	PISOS	OBSERVACIONES	MUROS	OBSERVACIONES	CIELOS RASOS	G/ESCOBAS	VARIOS
EDUCACIÓN PREESCOLAR							
AULA PRIMERA INFANCIA	A5		B1		C1	D5	E1
LUDOTECA	A5		B1		C1	D5	
BAÑOS	A4	1	B2	2/3/4	C1	D2	
RECREACIÓN EXTERIOR	A2/A11 A12/A13		B1			D1	

DEPENDENCIA	PISOS	OBSERVACIONES	MUROS	OBSERVACIONES	CIELOS RASOS	G/ESCOBAS	VARIOS
EDUCACIÓN PREESCOLAR							
AULA PRIMERA INFANCIA	A5		B1		C1	D5	E1
LUDOTECA	A5		B1		C1	D5	
BAÑOS	A4	1	B2	2/3/4	C1	D2	
RECREACIÓN EXTERIOR	A2/A11 A12/A13		B1			D1	
EDUCACIÓN PRIMARIA							
AULA GRADO 1 - 5	A4		B1		C1	D4	
LABORATORIO DE CIENCIAS	A4		B1		C1	D4	E3
AULA TALLER DE ARTE	A4		B1		C1	D4	E3
AULA TECNOLÓGICA	A4		B1		C1	D4	
BAÑOS	A4	1	B2	2/3/4	C1	D2	
RECREACIÓN EXTERIOR	A2/A13		B1			D1	
EDUCACIÓN BÁSICA SECUNDARIA							
AULAS GRADOS 6 - 9	A4		B1		C1	D4	
LABORATORIO FÍSICA QUÍMICA	A4		B1		C1	D4	E3
AULA TALLER DE ARTE	A4		B1		C1	D4	E3
AULA TECNOLÓGICA	A4		B1		C1	D4	
BAÑOS	A4	1	B2	2/3/4	C1	D2	
RECREACIÓN EXTERIOR	A2/A13		B1			D1	
EDUCACIÓN MEDIA							
AULAS GRADOS 10 - 11	A4		B1		C1	D4	
AULA TECNOLÓGICA	A4		B1		C1	D4	
BAÑOS	A4	1	B2	2/3/4	C1	D2	
RECREACIÓN EXTERIOR	A2/A13		B1			D1	

DEPENDENCIA	PISOS	OBSERVACIONES	MUROS	OBSERVACIONES	CIELOS RASOS	G/ESCOBAS	VARIOS
CENTRO INTEGRADO DE RECURSOS							
BIBLIOTECA	A4		B1		C1	D4	E2
AULA DE INFORMÁTICA	A4		B1		C1	D4	
SOCIALIZACIÓN Y BIENESTAR							
AULA MULTIPLE	A4		B1		C1	D4	
ATENCIÓN DE PÚBLICO COMESTIBLES	A4		B1		C1	D4	E2
BAÑOS	A4	1	B2	2/3/4	C1	D2	
EMISORA	A4		B1		C1	D4	
ADMINISTRACIÓN							
RECTORIA	A3/A4		B1		C1	D3/D4	
SECRETARIA	A3/A4		B1		C1	D3/D4	E2
BAÑO PRIVADO	A6		B2		C1		
ORIENTACIÓN Y PADRES DE FAMILIA	A3/A4		B1		C1	D3/D4	
COORDINACIÓN ACADÉMICA Y PROFESORES	A3/A4		B1		C1	D3/D	
BAÑOS PROFESORES	A4	1	B2	2/3/4	C1	D2	
ADMINISTRACION ARCHIVO Y FOTOCOPIADO	A3/A4		B1		C1	D3/D4	
ENFERMERIA	A4	1	B1		C1	D4	
BAÑOS ADMINISTRACION Y ENFERMERIA	A6		B2		C1		
DEPENDENCIA	PISOS	OBSERVACIONES	MUROS	OBSERVACIONES	CIELOS RASOS	G/ESCOBAS	VARIOS
SERVICIOS GENERALES							
BODEGA	A3		B1		C1	D3	
ALMACEN	A3		B1		C1	D3	
EQUIPOS	A3		B1		C1	D3	
BASURAS	A4	1	B2		C1	D2	
PORTERÍA	A3		B1		C1	D3	E2
BAÑOS Y VESTIER PERSONAL	A4	1	B2		C1	D2	

DEPENDENCIA	PISOS	OBSERVACIONES	MUROS	OBSERVACIONES	CIELOS RASOS	G/ESCOBAS	VARIOS
RECREACIÓN							
CANCHA MÚLTIPLE	A7						
TIENDA ESCOLAR	A3	1	B2		C1	D2	
AUDITORIO AL AIRE LIBRE	A2		B1			D1	
PATIO DE BANDERAS	A2		B1			D1	
OTROS							
ANDENES EXTERIORES	A1		B1				
HALLS Y CIRCULACIONES INTERIORES	A3/A4		B1		C1	D3/D4	
CIRCULACIONES EXTERIORES	A1		B1				
PATIOS INTERIORES	A2		B1			D1	
ESCALERAS INTERIORES	A8		B1		C1		
ESCALERAS EXTERIORES	A9		B1				
RAMPAS	A10		B1		C1		

Las especificaciones de cada elemento, se describen a continuación según la nomenclatura usada en los cuadros anteriores:

Acabados para pisos

- A1** Andenes en concreto escobillado
- Andenes en concreto lavado
- Plaquetas prefabricadas en concreto reforzado
- Confinamiento andenes en concreto reforzado, elementos prefabricados
- A2** Adoquines en concreto
- Adoquines en arcilla
- Tolete de plano como adoquín

- A3** Pisos en arcilla cocida y vitrificada o gres
 Tablón Cuarto x 26
 Tabletas y tablonés de gres de diferentes medidas
- A4** Baldosín de granito vibropresado de 0.30 x 0.30 o 0.33 x 0.33 ms.
 Grano No 1, Colores claros
- A5** Baldosa de caucho para tráfico pesado.
- A6** Baldosín de porcelana o cerámica de 0.20 x 0.20 o de 0.30 x 0.30 ms.
 Fabricación mediante proceso de monococción, alta resistencia, bajo nivel de absorción. Tráfico 4.
- A7** Pavimento en concreto reforzado
- A8** Gradas en ladrillo tolete moldurado
 Gradas en gravilla lavada
 Gradas en gravilla lavada y tableta de gres
 Gradas en granito pulido con pirlán de cobre y cintas antideslizantes
 Enchapes en tablonés de gres con perfil para gradas.
- A9** Gradas en ladrillo tolete
 Gradas en concreto lavado
- A10** Concreto escobillado
 Concreto lavado
- A11** Piso en deck sintético en PVC
- A12** Recubrimiento sintético de alta resistencia (caucho)
- A13** El césped

Observaciones sobre pisos

Cenefas en granito para conformar media caña.

Acabados muros

- B1** Muros en concreto reforzado a la vista.
- Muros en ladrillo de arcilla a la vista con perforaciones verticales.
- Muros en bloque de concreto a la vista con perforaciones verticales.
- B2** Baldosín de porcelana de 0.20 x 0.20 o 0.30 x 0.30 ms. Altura del enchape de 180 ms. Filos y dilataciones con esquineros y platinas de aluminio crudo. A partir de esta altura, se aplicará pintura plástica sobre pañete.

Observaciones sobre muros

- 1 Divisiones para cabinas prefabricadas en lámina *cold rolled* con pintura electrostática o en lámina de acero inoxidable.
- 2 Mesones en concreto reforzado con enchape en granito pulido.
- 3 Puertas para cabinas en lámina *cold rolled* recubiertas con pintura electrostática o en lámina de acero inoxidable.

Acabados cielos rasos

- C1** Estructura en concreto reforzado a la vista o en crudo.
- Teja aislada sobre estructura metálica.

Acabados guardaescobas

- D1** Arranque de mampostería en hilada de plano o hilada parada
- D2** Media caña en granito pulido
- D3** Zócalos en gres para tablones y tabletas
- D4** Zócalos en baldosín de granito vibro prensado
- D5** Zócalos en caucho

Cargas Muertas

Se utilizará una losa de metaldeck de 2" calibre 18 con altura de 11 cm de losa completa con concreto y 2 cm de espesor de acabado de piso en concreto

Componente	Carga (kN/m ²) m ² de área en planta	Carga (kgf/m ²) m ² de área en planta
Pisos y acabados		
Acabado de piso en concreto	0.0200 (por mm de espesor)	20 (por cm de espesor)

En la plataforma se pondrán = 40 kg/m²

Las barandas laterales se diseñan para que soporten el peso de teja sencilla de aluminio o zinc con peso con accesorios de 20 kg/m²

Cargas vivas

Se usan las cargas que se describen en la tabla B.4.2.1-1

Educativos	Salones de clase	2.0	200
	Corredores y escaleras	5.0	500
	Bibliotecas		
	Salones de lectura	2.0	200
	Estantorias	7.0	700

B.4.2.2 — EMPUJE EN PASAMANOS Y ANTEPECHOS — Las barandas, pasamanos de escaleras y balcones, y barras auxiliares tanto exteriores como interiores, y los antepechos deben diseñarse para que resistan una fuerza horizontal de 1.00 kN/m (100 kgf/m) aplicada en la parte superior de la baranda, pasamanos o antepecho y deben ser capaces de transferir esta carga a través de los soportes a la estructura. Para viviendas unifamiliares, la carga mínima es de 0.4 kN/m. (40 kgf/m). En estadios y coliseos esa carga mínima horizontal de barandas y antepechos no será menor de 2.5 kN/m (250 kgf/m). En estos y otros escenarios públicos las barandas deberán ser sometidas a pruebas de carga, las cuales deben ser dirigidas y documentadas por el Supervisor Técnico antes de ser puestas en servicio.

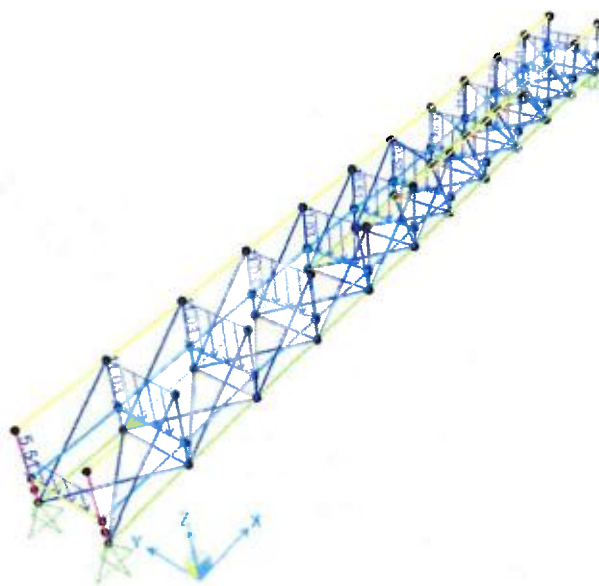


Figura 6 aplicación carga viva rampa tipo 1

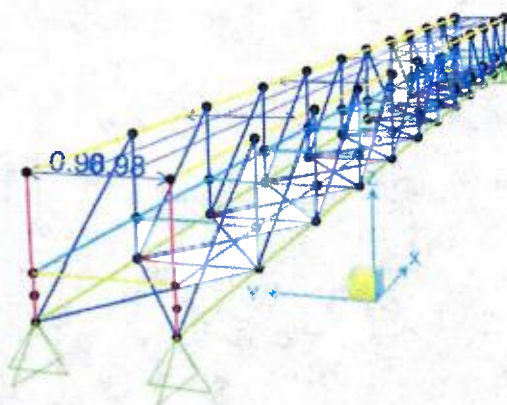


Figura 7 aplicación carga viva barandas rampa tipo 1

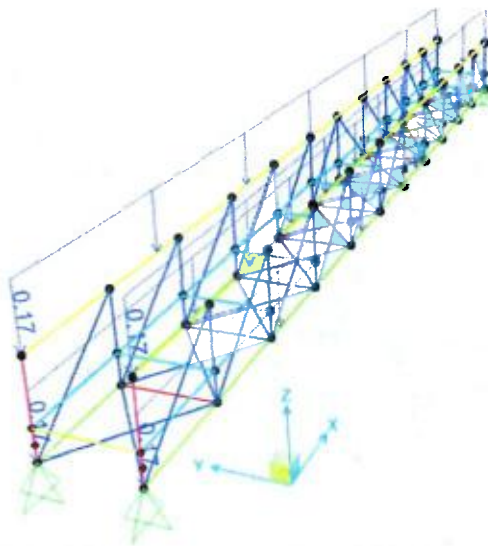


Figura 8 aplicación carga muerta barandas rampa tipo 1

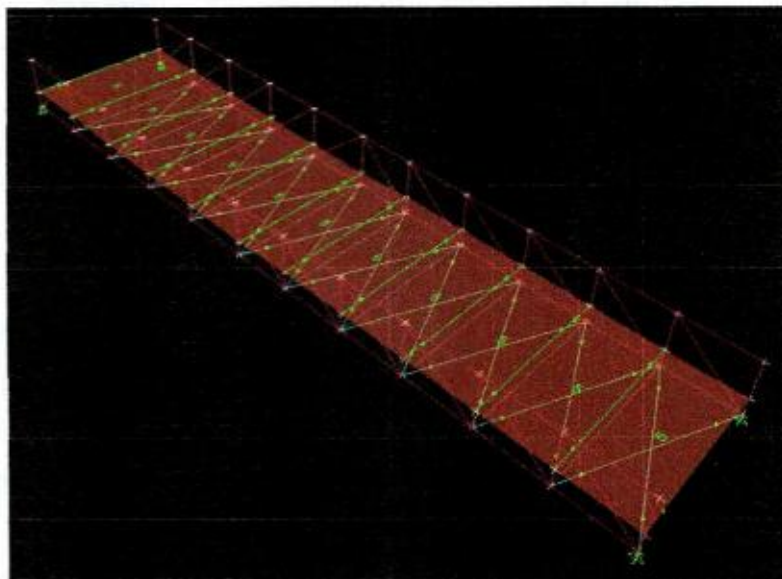


Figura 9 aplicación carga viva rampa tipo 2 y 3

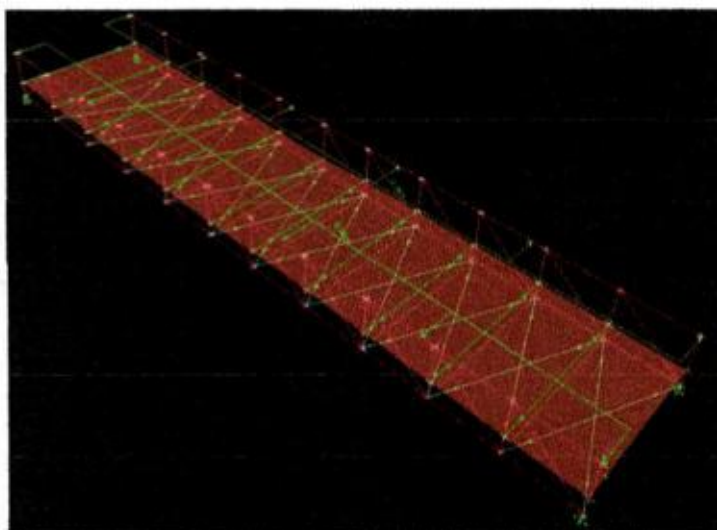


Figura 10 aplicación carga viva barandas rampa tipo 2 y 3

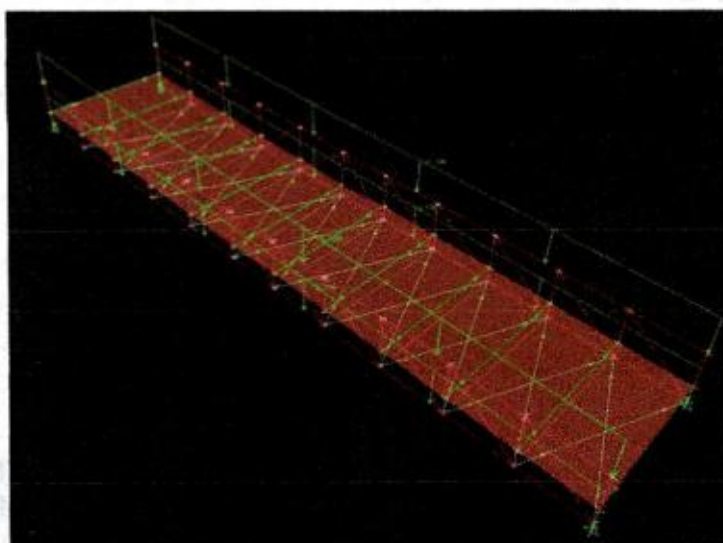


Figura 11 aplicación carga muerta rampa tipo 2 y 3

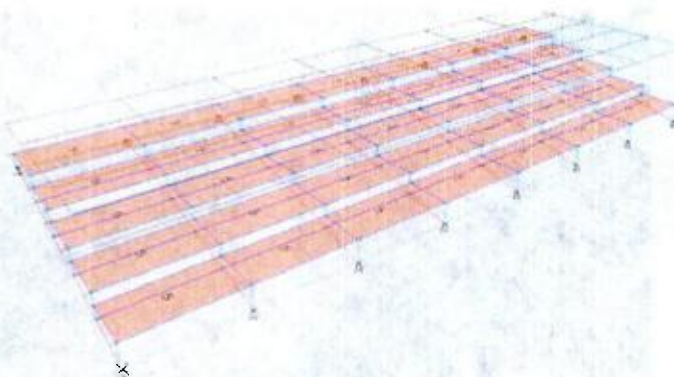


Figura 12 aplicación carga viva rampa tipo 4

4. ANÁLISIS SÍSMICO

4.1 ZONA DE AMENAZA SÍSMICA DE ACUERDO CON LA MICROZONA SÍSMICA

Según el decreto 523 del 16 diciembre de 2010, por el cual se adopta la microzonificación sísmica de Bogotá D.C y se definen sus respectivas curvas y parámetros de diseño estructural sismo resistente. A partir de la información presente en el Estudio de Microzonificación, se construyeron los espectros elásticos de aceleración, y Curva elástica de Umbral de daño.

De acuerdo con la ubicación del proyecto, éste se encuentra en la Micro-Zona: Aluvial 200

- Dirección del predio: Calle 45sur N.º 72Q-20
- Barrio: Boitá
- Localidad: 8 Kennedy.

El proyecto está localizado a una distancia aproximada de 826m de la Microzona más cercana Aluvial-100. Por lo tanto, no se hace necesario hacer un promedio de coeficientes y curvas debido a que esta distancia es mayor a 100m, tal como lo recomienda el decreto. Los mapas de localización y de microzonificación de la ciudad de Bogotá D.C, se consultaron a través de los mapas interactivos del sistema de Infraestructura de Datos Espaciales para el Distrito Capital IDECA. A partir del portal Geoportal Gestión de Riesgos y Atención de Emergencias.

Esta información se puede consultar en los siguientes enlaces:

<https://www.ideca.gov.co/recursos/aplicaciones/geoportal-gestion-de-riesgos-y-atencion-de-emergencias>
<https://idiger.maps.arcgis.com/apps/webappviewer/index.html?id=fa4b277533584c3a95a9208b4d542e19>

A continuación, se presenta la localización general en el mapa de microzonificación sísmica de la ciudad de Bogotá D.C.

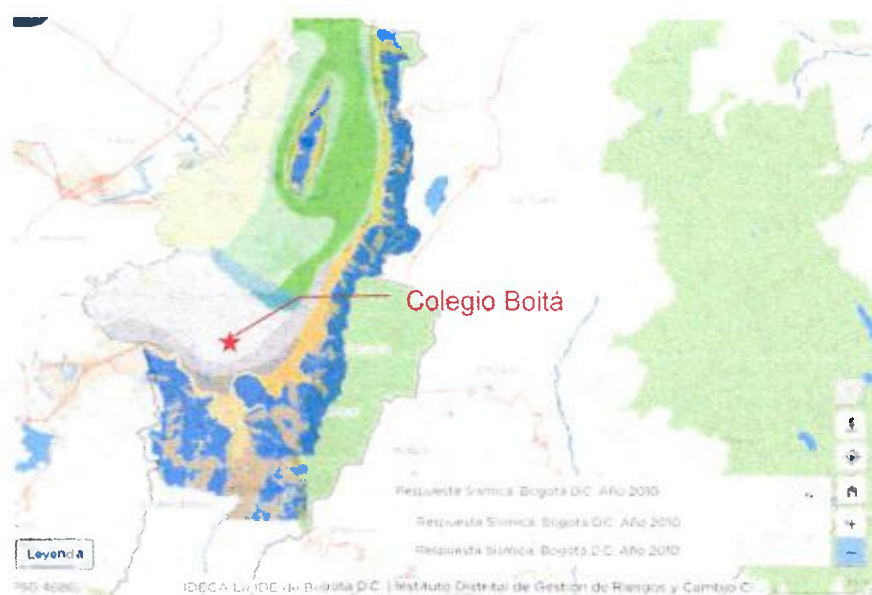


Figura 13 Localización del Proyecto en Mapa de Microzonificación Bogotá D.C

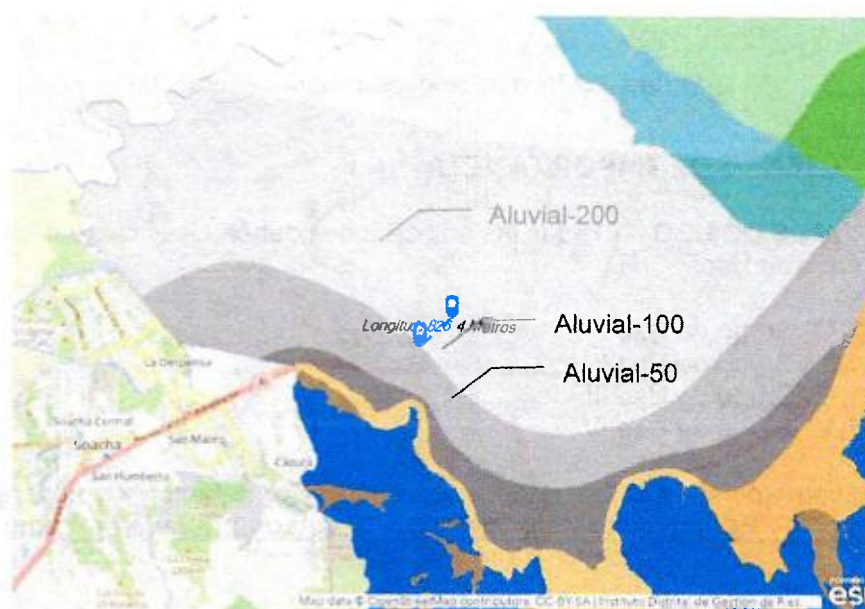


Figura 14 Localización a más de 200m de la Mircozona Aluvial-100



Figura 15 Zona de respuesta sísmica Aluvial-200

4.2 COEFICIENTE DE IMPORTANCIA

A.2.5.1 — GRUPOS DE USO — Todas las edificaciones deben clasificarse dentro de uno de los siguientes Grupos de Uso:

- A.2.5.1.4.- Grupo de Uso I
- A.2.5.1.3.- Grupo de Uso II
- A.2.5.1.2.- Grupo de Uso III
- A.2.5.1.1.- Grupo de Uso IV

La edificación corresponde a una institución educativa, por lo tanto, la edificación pertenece al **Grupo de Uso III- Edificaciones de atención a la comunidad**, tal como se describe a continuación:

A.2.5.1.2 — Grupo III — Edificaciones de atención a la comunidad — Este grupo comprende aquellas edificaciones, y sus accesos, que son indispensables después de un temblor para atender la emergencia y preservar la salud y la seguridad de las personas, exceptuando las incluidas en el grupo IV. Este grupo debe incluir:

- (a) Estaciones de bomberos, defensa civil, policía, cuarteles de las fuerzas armadas, y sedes de las oficinas de prevención y atención de desastres,
- (b) Garajes de vehículos de emergencia,
- (c) Estructuras y equipos de centros de atención de emergencias,
- (d) Guarderías, escuelas, colegios, universidades y otros centros de enseñanza,
- (e) Aquellas del grupo II para las que el propietario desee contar con seguridad adicional, y
- (f) Aquellas otras que la administración municipal, distrital, departamental o nacional designe como tales.

A.2.5 — COEFICIENTE DE IMPORTANCIA

A.2.5.2 — COEFICIENTE DE IMPORTANCIA — El Coeficiente de Importancia, I , modifica el espectro, y con ello las fuerzas de diseño, de acuerdo con el grupo de uso a que esté asignada la edificación para tomar en cuenta que para edificaciones de los grupos II, III y IV deben considerarse valores de aceleración con una probabilidad menor de ser excedidos que aquella del diez por ciento en un lapso de cincuenta años considerada en el numeral A.2.2.1, Los valores de I se dan en la tabla A.2.5-1.

Grupo de Uso	Coeficiente de Importancia, I
IV	1.50
III	1.25
II	1.10
I	1.00

De acuerdo con la tabla A.2.5-1 el coeficiente de importancia es $i=1.25$.

4.3 TIPO DE PERFIL DE SUELO

De acuerdo con la información presente en el estudio de suelos, la estratigrafía está caracterizada por sobre rellenos de material del sitio con grava y escombros en un espesor variable. A continuación, se encuentran capas de limos arcillosos de alta plasticidad, de consistencia media a dura y algo de arena.

De acuerdo con la información presente en el decreto de microzonificación sísmica el comportamiento geotécnico general de esta micro zona es:

Nombre	Geotecnia	Geología	Geomorfología	Composición principal	Comportamiento geotécnico general	Espesor
Cerros A	Roca de arenisca	Formaciones de Areniscas	Cerros de alta pendiente	Areniscas duras	Rocas competentes y resistentes a la meteorización, eventuales problemas de estabilidad de taludes en excavaciones a cielo abierto, principalmente cuando estén fracturadas o con intercalaciones de arcillolitas blandas	
Cerros B	Roca de arcillolita	Formaciones de Arcillolitas	Cerros de moderada a alta pendiente	Arcillolitas blandas	Rocas de moderada competencia y susceptibles a la meteorización, problemas de estabilidad de taludes en excavaciones a cielo abierto, principalmente cuando estén fracturadas	
Piedemonte A	Suelo coluvial y aluvial norte	Coluviones y Complejo de Conos Aluviales	Piedemonte	Gravas arcillo arenosas compactas	Suelos de alta capacidad portante pero pueden presentar problemas de inestabilidad en excavaciones abiertas	50 m
Piedemonte B	Suelo coluvial y aluvial centro			Gravas areno arcillosas compactas		
Piedemonte C	Suelo coluvial y aluvial sur			Gravas areno arcillosas compactas		
Lacustre A	Suelo lacustre muy blando	Terreza Alta - Lacustre	Planicie	Arcillas limosas muy blandas	Suelos de muy baja a media capacidad portante y muy compresibles	20 - 500 m
Lacustre B	Suelo lacustre blando			Arcillas limosas blandas		
Lacustre C	Suelo lacustre - aluvial			Arcillas arenosas firmes		
Aluvial	Suelo aluvial grueso a medio	Terreza Baja - Aluvial y Complejo de Conos Aluviales	Planicie	Arenas arcillosas sueltas a compactas	Suelos de mediana a alta capacidad portante poco compresibles, susceptibles a licuación e inestables en excavaciones a cielo abierto	50 - 250 m
Llanura A	Suelo de llanura - lacustre	Llanura de Inundación	Llanura	Arenas sueltas y arcillas limosas blandas	Suelos de moderada capacidad portante y compresibles, susceptibles a licuación	200 - 500 m
Llanura B	Suelo de llanura - aluvial			Arenas sueltas y arcillas arenosas duras		
Cauce	Cauce activo o antiguo	Cauces Activos	Piedemonte y Planicie	Gravas arenosas sueltas a compactas	Suelos de baja a mediana capacidad portante, susceptibles a licuación y problemas de estabilidad de taludes	
Depósitos	Suelo de ladera	Depósitos de Ladera	Cerros	Gravas areno arcillosas compactas	Suelos de mediana capacidad portante susceptibles a problemas de estabilidad de taludes	5 - 15 m
Residual	Suelo residual	Suelo Residual	Cerros	Arcillas gravo arenosas firmes	Suelos de mediana a alta capacidad portante con posibles problemas de estabilidad de taludes en sectores de alta pendiente	5 - 10 m
Basura	Relleno de basura	Rellenos de Basuras	Piedemonte y Planicie	Basuras	Materiales heterogéneos, que acuerdo con su disposición pueden ser compresibles y susceptibles a problemas de estabilidad en taludes	
Relleno	Relleno de excavación	Rellenos de Excavación	Piedemonte y Planicie	Rellenos heterogéneos	Materiales heterogéneos, que acuerdo con su disposición pueden ser compresibles y susceptibles a problemas de estabilidad en taludes	
Excavación	Excavación especial	Excavaciones Especiales	Piedemonte	Gravas arenosas sueltas a compactas	Zonas de explotación de agregados en el Río Tunjuelo, susceptibles a problemas de estabilidad de taludes	

Tabla 4.1. Descripción de las zonas geotécnicas

4.4 ESPECTRO DE DISEÑO

Espectros de elásticos de aceleración

Zona	Fa475 D=5%	Fv475 D=5%	Ao475 (g)	Tl (s)
CERROS	1.35	1.30	0.18	3.0
PIEDEMONTA A	1.65	2.00	0.22	3.0
PIEDEMONTA B	1.95	1.70	0.26	3.0
PIEDEMONTA C	1.80	1.70	0.24	3.0
LACUSTRE-50	1.40	2.90	0.21	4.0
LACUSTRE-100	1.30	3.20	0.20	4.0
LACUSTRE-200	1.20	3.50	0.18	4.0
LACUSTRE-300	1.05	2.90	0.16	5.0
LACUSTRE-500	0.95	2.70	0.14	5.0
LACUSTRE ALUVIAL-200	1.10	2.80	0.17	4.0
LACUSTRE ALUVIAL-300	1.00	2.50	0.15	5.0
ALUVIAL-50	1.35	1.80	0.20	3.5
ALUVIAL-100	1.20	2.10	0.18	3.5
ALUVIAL-200	1.05	2.10	0.16	3.5
ALUVIAL-300	0.95	2.10	0.14	3.5
DEPOSITO LADERA	1.65	1.70	0.22	3.0

Tabla 1 Parámetros Ao, Fa y Fv para espectro de diseño Tr=475años

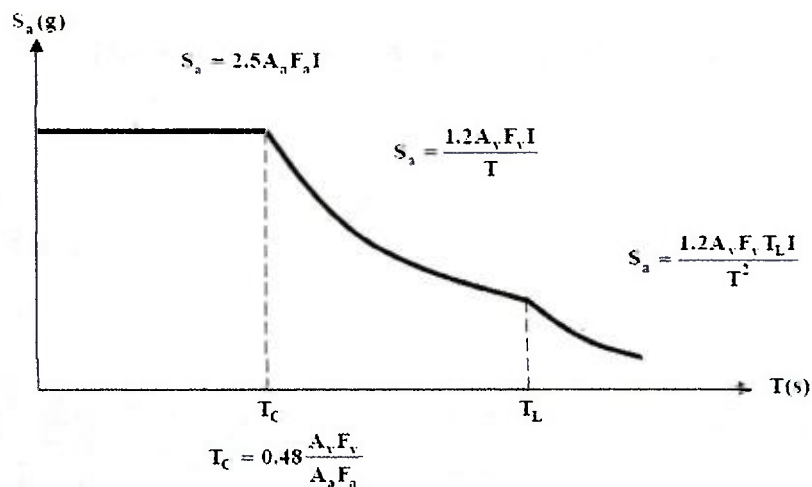


Figura 16 Curva de diseño para un coeficiente de amortiguamiento ξ de 5%

Parámetros

- A_a = Aceleración horizontal pico efectiva de diseño. $A_a = 0.15$ g
 A_v = Aceleración que representa la velocidad horizontal pico efectiva de diseño. $A_v = 0.20$ g
 A_0 = Aceleración horizontal pico efectiva del terreno en superficie (g)
 F_a = Coeficiente de amplificación que afecta la aceleración en la zona de periodos cortos
 F_v = Coeficiente de amplificación que afecta la aceleración en la zona de periodos intermedios
 I = Coeficiente de importancia
 S_a = Aceleración espectral (g)
 T = Periodo de vibración (s)
 T_c = Periodo corto (s)
 T_L = Periodo largo (s)

Aa	0.15
Av	0.20
Tr	475 años
Fa	1.05
Fv	2.10
To,	0.27
Tc	1.28
TL	3.50
I	1.25

Tabla 2 Parámetros de sitio Zona Aluvial-200

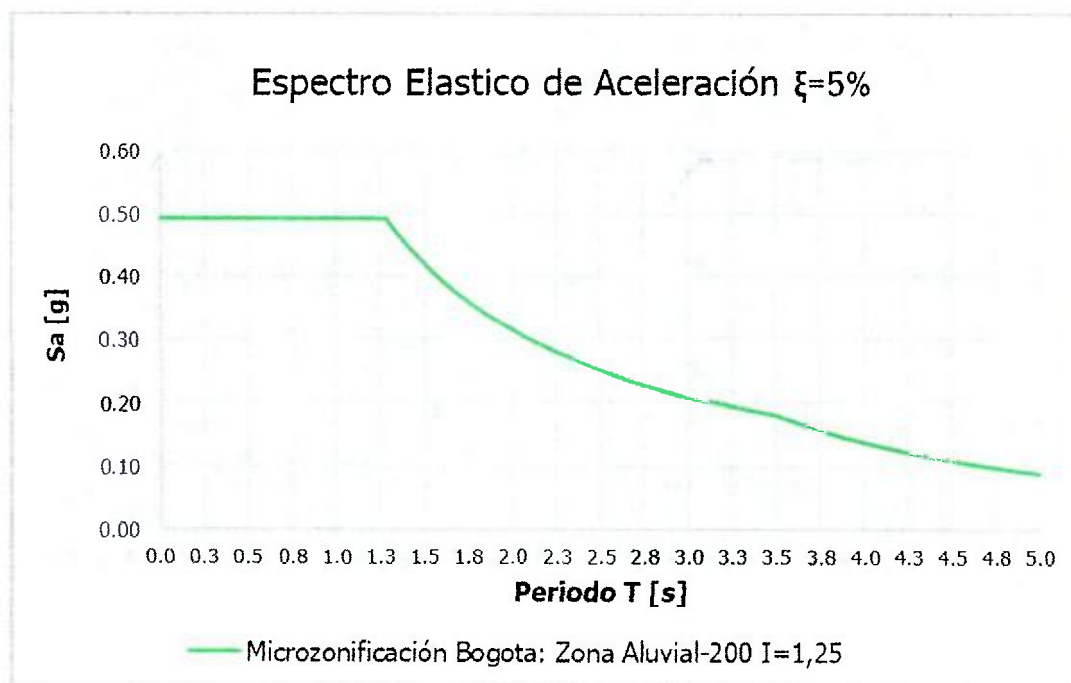


Figura 17 Espectro elástico de diseño $i=1.25$

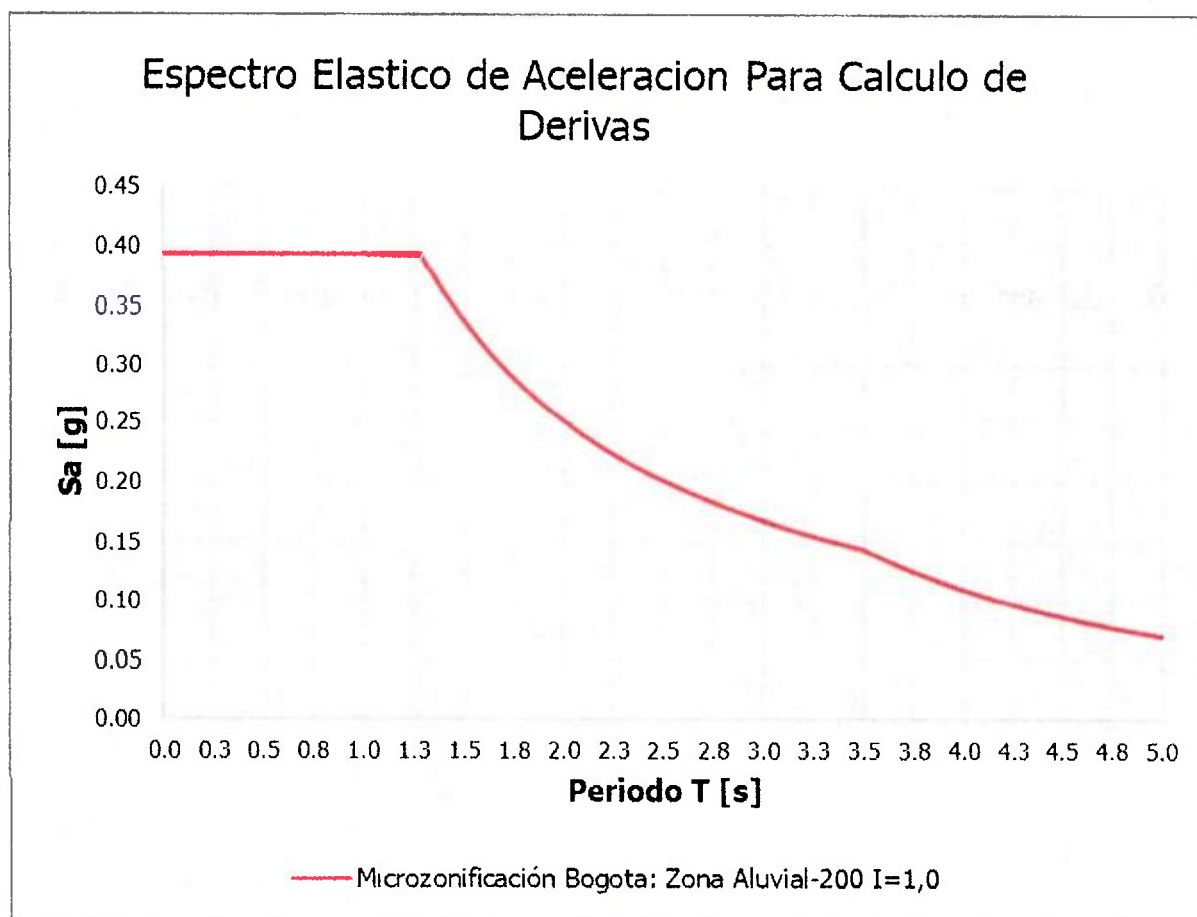


Figura 18 Espectro elástico de aceleración I=1.0

Para el cálculo de la fuerza horizontal sobre un elemento estructural que no hace parte del sistema de resistencia sísmica, se utiliza la siguiente ecuación.

$$F_p = \frac{a_s g}{R_0} M_p$$

A.8.2.1.2 — Método del análisis dinámico — Cuando se utilice el método del análisis dinámico, la aceleración horizontal, a_s , expresada como un porcentaje de la aceleración de la gravedad, sobre el elemento estructural que no hace parte del sistema de resistencia sísmica, localizado en el piso n , es igual a la aceleración a que se ve sometido el piso después de realizar el ajuste de resultados prescrito en A.5.4.5. El valor de la aceleración obtenida por medio del método del análisis dinámico no puede ser menor que el que se obtiene por medio de la ecuación A.8.2-1.

S_{ax} :	0.492
S_{ay} :	0.492

$$a_i = A_s + \frac{(S_a - A_s) h_i}{h_{eq}} \quad h_i \leq h_{eq}$$

$$a_i = S_a \frac{h_i}{h_{eq}} \quad h_i \geq h_{eq}$$

$R0 = 1.5$ coeficiente de disipación de energía utilizado en el diseño de las rampas metálicas

$$F_p = \frac{0.492 \cdot 1.13 \cdot 9.81}{1.5} \cdot M_p = 3.64 \cdot M_p$$

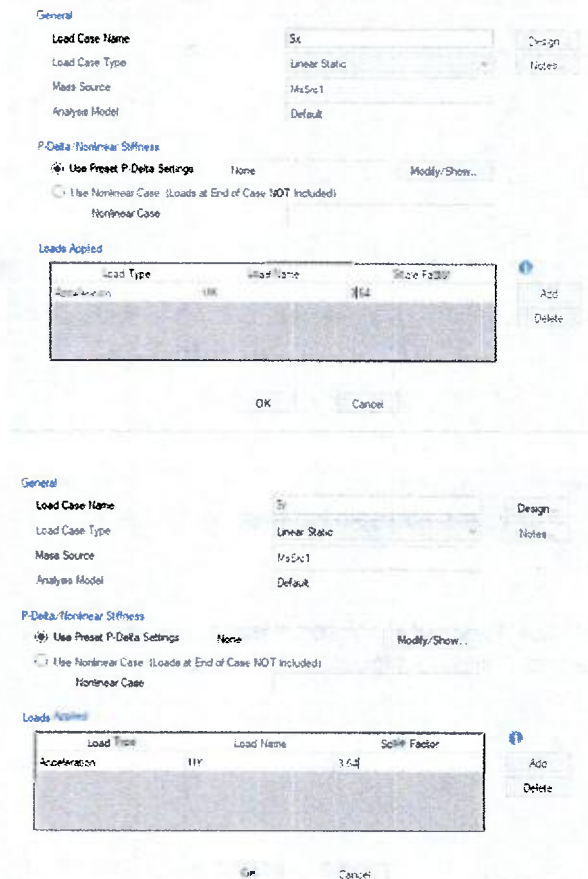


Figura 19 Aceleración sísmica horizontal del elemento no estructural

4.5 PARÁMETROS Y REQUISITOS DE DISEÑO

El método de análisis a utilizar es el análisis dinámico elástico, que según el A.3.4.2 (NSR-10) permite analizar casi cualquier tipo de edificación. Dentro del análisis dinámico, se utilizará el análisis dinámico elástico espectral, cumpliendo con los requisitos del título A.5.4.

Las fuerzas sísmicas de diseño se introducirán por medio del espectro elástico de diseño definido en el A.2 NSR-10. De acuerdo a la **Zona de Amenaza Sísmica intermedia de la ciudad de Bogotá D.C.**, al tipo de material estructural, y las características del sistema de resistencia sísmica se estableció el grado de Capacidad Moderada de Disipación Energía (**DMO**), el cual debe cumplir con los requisitos según el nivel de amenaza sísmica, efectos locales e importancia de la estructura.

A.7.3 — ANÁLISIS Y DISEÑO ESTRUCTURAL

A continuación, se describe el alcance mínimo de los aspectos que debe tener en cuenta el ingeniero estructural para describir los efectos de interacción suelo-estructura:

A.7.3.1 — TIPO DE MODELO — Los modelos matemáticos pueden ser estáticos o dinámicos y deben describir las características de rigidez de la estructura, la cimentación y el suelo, a niveles compatibles con las deformaciones esperadas. En los modelos estructurales utilizados en el análisis de la estructura deben introducirse condiciones de apoyo elástico de los muros, columnas y elementos del sistema de resistencia sísmica al nivel de la cimentación, consistentes con las rigideces supuestas para obtener la respuesta de la estructura teniendo en cuenta los efectos de interacción suelo-estructura.

A.7.3.2 — FUERZAS DE DISEÑO DE LOS ELEMENTOS ESTRUCTURALES — El modelo matemático empleado debe utilizarse en la evaluación de las características propias de la respuesta de la estructura ante las diferentes solicitaciones. La distribución de las fuerzas internas de la estructura que se utilice en el diseño de la misma debe ser la que se obtiene a través del análisis que incluye los efectos de interacción suelo-estructura.

4.6 COMBINACIONES DE SERVICIO

El cálculo de los estados límites de servicio, se evalúan según las combinaciones presentes en el Capítulo B.2.3.

$$D+F$$

$$D+H+F + T +L$$

$$D+H+F+(Lr \text{ ó } G \text{ ó } Le)$$

$$D+H+F+0,75(L+T)+0,75(Lr \text{ ó } G \text{ ó } Le)$$

$$D+H+F+W$$

$$D+H+F+0,7E$$

$$D+H+F+0,75W+0,75L+0,75(Lr \text{ ó } G \text{ ó } Le)$$

$$D+H+F+0,75(0,7E)+0,75L+0,75(Lr \text{ ó } G \text{ ó } Le)$$

$$0,6D+W+H$$

Dónde:

D: Carga muerta consistente en el peso propio del elemento y muros.

L: Carga viva debidas al uso y aplicación de la edificación

E: Fuerzas sísmicas reducidas de diseño

W: Fuerzas de viento

Lr: Carga viva de cubierta

G: Granizo

H: Presión de tierra

4.7 COMBINACIONES DE DISEÑO

El cálculo de las cargas actuantes sobre la estructura se realiza utilizando las combinaciones especificadas en el NSR-10. En el Capítulo B.2.4 se indica que las estructuras deben diseñarse de tal manera que su resistencia de diseño exceda los efectos de las cargas mayoradas de acuerdo con las siguientes combinaciones especificadas.

1.4 (D+F)	(B.2.4-1)
1.2 (D+ F + T) + 1.6 (L + H) + 0.5 (Lr ó G ó Le)	(B.2.4-2)
1.2D + 1.6 (Lr ó G ó Le) + (L ó 0.8W)	(B.2.4-3)
1.2D + 1.6W +1.0L + 0.5(Lr ó G ó Le)	(B.2.4-4)
1.2D + 1.0E + 1.0L	(B.2.4-5)
0.9D + 1.6W +1.6H	(B.2.4-6)
0.9D + 1.0E + 1.6H	(B.2.4-7)

- Dónde:
- D: Carga muerta consistente en el peso propio del elemento y muros.
 - L: Carga viva debidas al uso y aplicación de la edificación
 - E: Fuerzas sísmicas reducidas de diseño
 - W: Fuerzas de viento
 - Lr: Carga viva de cubierta
 - G: Granizo
 - H: Presión de tierra

La carga de peso propio la tiene en cuenta el programa, la cual es mayorada por el factor correspondiente. En total resultan 22 combinaciones de carga más una envolvente.

4.8 VERIFICACIÓN DE DEFLEXIONES

Se revisarán las deflexiones con las especificaciones de la normativa de puentes AASHTO para cargas vivas peatonales de $L/500$

5—DEFLECTIONS

"Deflections should be investigated at the service limit state using load combination Service I in Table 3.4.1-1 of AASHTO LRFD. For spans other than cantilever arms, the deflection of the bridge due to the unfactored pedestrian live loading shall not exceed $1/500$ of the span length. Deflection in cantilever arms due to the pedestrian live loading shall not exceed $1/220$ of the cantilever length. Horizontal deflections under unfactored wind loading shall not exceed $1/360$ of the span length."

Nation	Spec. name	Issued by	Scope of application	Live load (kN/m ²)	Deflection limit
U.K.	DMFRB Vol. 1, Sec. 3, Part 17 (DTD, 2005)	Department of Transport	FRP highway bridges and structures	-	$L/300$
U.S.A.	A Guide to Fiber-Reinforced Polymer Trail Bridges (DAFS, 2006)	Forest Service, U.S. Department of Agriculture	FRP trail bridges	4.07	$L/400$
	LRFD Guide Specifications for Design of Pedestrian Bridges (AASHTO, 2000)	AASHTO	Pedestrian bridges	4.07	$L/500$
	Guide Specifications for Design of FRP Pedestrian Bridges (AASHTO, 2008)	AASHTO	FRP pedestrian bridges	4.07	$L/500$
Japan	Guidelines for Design and Construction of FRP footbridges (JSCE, 2011)	Japan Society of Civil Engineers	FRP footbridges	5.0	Main girder $L/500$; other components $L/400$

Figura 20 Limite de deflexiones puentes peatonales

Verificación deflexiones rampa tipo 1



Figura 21 Deflexión carga viva rampa 1 -3.4 cm.

Longitud de la pasarela: 2400cm
 Deflexión por carga viva: -3.4cm

Deflexión admisible:

$$3.4\text{cm} \leq \frac{l}{500} = \frac{2400}{500} = 4.8\text{cm}: \text{Cumple}$$

Verificación deflexiones rampa tipo 2

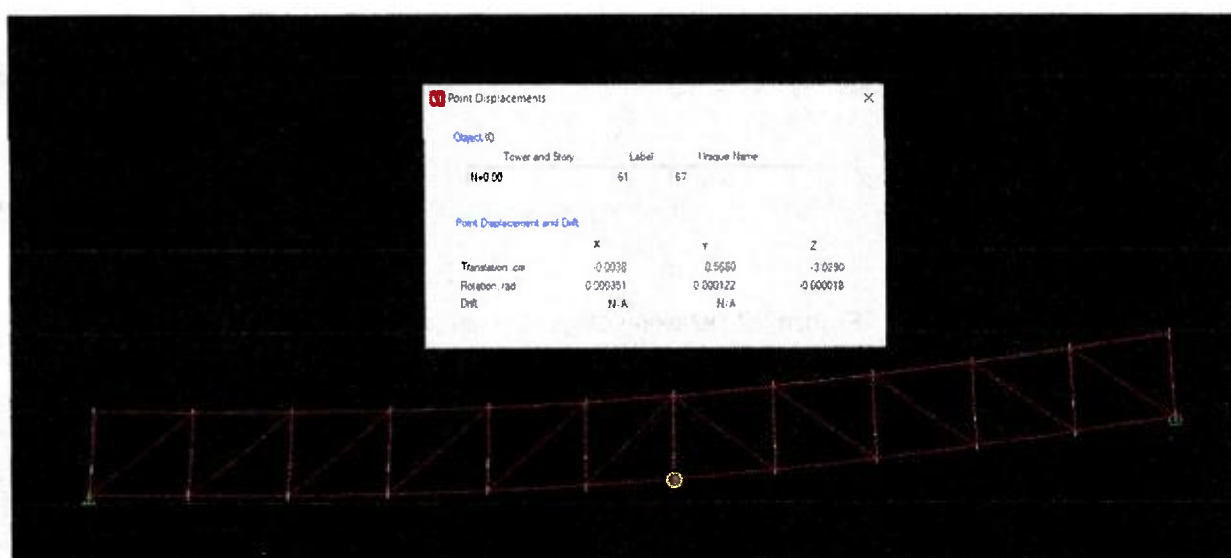


Figura 22 Deflexión carga viva rampa 2 -3.02 cm.

Longitud de la pasarela: 2400cm
 Deflexión por carga viva: -3.02cm

Deflexión admisible:

$$3.02\text{cm} \leq \frac{l}{500} = \frac{2400}{500} = 4.8\text{cm}: \text{Cumple}$$

Verificación deflexiones rampa tipo 3

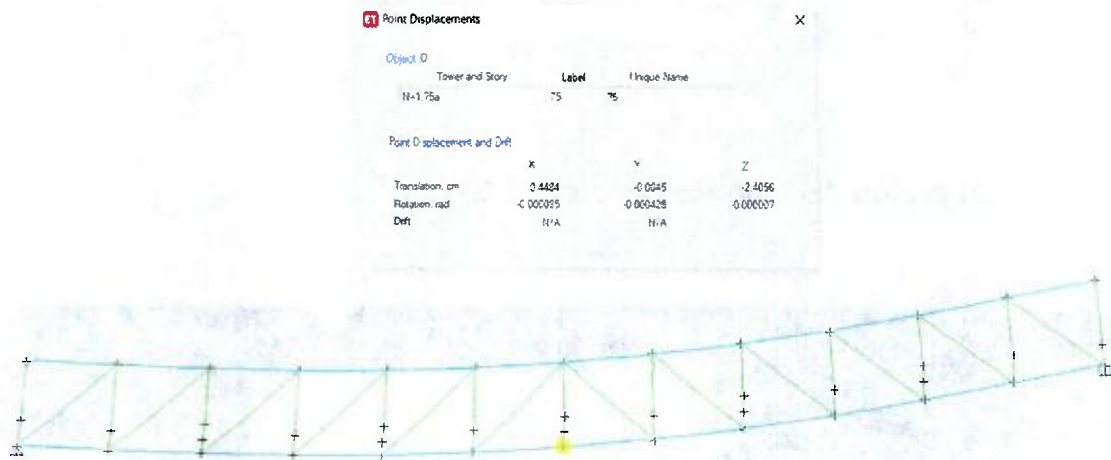


Figura 23 Deflexión carga viva rampa 3 -2.41 cm.

Longitud de la pasarela: 2400cm
 Deflexión por carga viva: -2.41cm

Deflexión admisible:

$$-2.41\text{cm} \leq \frac{l}{500} = \frac{2400}{500} = 4.8\text{cm: Cumple}$$

Verificación deflexiones rampa tipo 4



Figura 24 Deflexión carga viva rampa 3 -2.41 cm.

Longitud de la pasarela: 780cm
 Deflexión por carga viva: -2.41cm

Deflexión admisible:

$$-2.41\text{cm} \leq \frac{l}{500} = \frac{780}{500} = 1.56\text{ cm: Cumple}$$

4.9 VERIFICACIÓN DE VIBRACIONES EN EL TABLERO DE LAS PASARELAS

Se revisarán las vibraciones admisibles en el tablero de las rampas basados en las aceleraciones máximas permisibles y periodos de vibración natural del tablero recogidos en la guía de diseño 11 del AISC (Floor vibrations due to human activity) y la normativa de diseño para puentes peatonales AASHTO LRFD

6—VIBRATIONS

Unless waived by the Owner, vibrations shall be investigated as a service limit state using load combination Service I in Table 3.4.1-1 of AASHTO LRFD. Vibration of the structure shall not cause discomfort or concern to users of a pedestrian bridge. Except as specified herein, the fundamental frequency in a vertical mode of the pedestrian bridge without live load shall be greater than 3.0 hertz (Hz) to avoid the first harmonic. In the lateral direction, the fundamental frequency of the

pedestrian bridge shall be greater than 1.3 Hz. If the fundamental frequency cannot satisfy these limitations, or if the second harmonic is a concern, an evaluation of the dynamic performance shall be made. This evaluation shall consider:

- The frequency and magnitude of pedestrian footfall loadings
- The phasing of loading from multiple pedestrians on the bridge at the same time, including the "lock-in" phenomena
- Appropriate estimation of structural damping
- Frequency dependent limits on acceleration and/or velocity

Table 4.1 Recommended Values of Parameters in Equation (4.1) and a_o/g Limits			
	Constant Force P_o	Damping Ratio β	Acceleration Limit $a_o/g \times 100\%$
Offices, Residences, Churches	0.29 kN (65 lb)	0.02–0.05*	0.5%
Shopping Malls	0.29 kN (65 lb)	0.02	1.5%
Footbridges—Indoor	0.41 kN (92 lb)	0.01	1.5%
Footbridges—Outdoor	0.41 kN (92 lb)	0.01	5.0%

* 0.02 for floors with few non-structural components (ceilings, ducts, partitions, etc.) as can occur in open work areas and churches.
0.03 for floors with non-structural components and furnishings, but with only small demountable partitions, typical of many modular office areas.
0.05 for full height partitions between floors.

Tabla 3 valores recomendados de aceleración límite

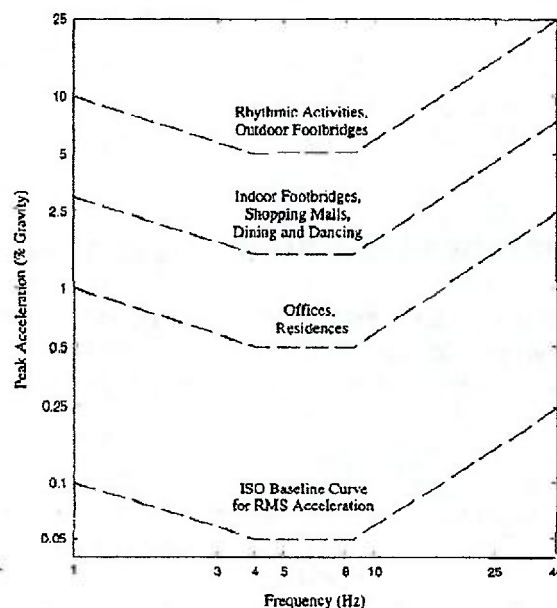


Figura 25 criterio de aceptación de la aceleración

Verificación vibraciones rampa tipo 1

4. CHEQUEO DE VIBRACIONES INDUCIDAS POR ACTIVIDADES HUMANAS

4.1. ESPECIFICACIONES

GUÍA DE DISEÑO

AISC - Steel Design Guide Series
Volumen 11

USO Y OCUPACIÓN

La edificación está destinada al uso como
Actividad Rítmica Predominante

Puente Peatonal Interior
Ninguna

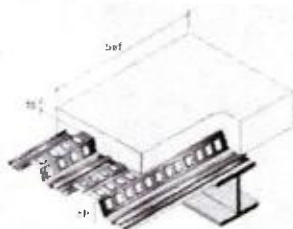
4.2. CARGA DE SERVICIO

Carga Muerta **DL**
Carga Viva **LL**
Carga de Servicio **CS**

DL = 50.00 Kg/m²
LL = 500.00 Kg/m²
CS = 550.00 Kg/m²

4.3. PROPIEDADES DE ELEMENTOS

A. STEEL DECK



Espesor de losa Hc = 110 mm
Lámina Colaborante Hr = 50.80 mm
Sobre-Espesor de Concreto tc = 59.20 mm
Peso losa + lámina Wsd = 206.93 Kg/m²

B. VIGAS



VIGUETA tubo 120x60

A = 10.44 cm²
d = 120.00 mm
Ix = 197.31 cm⁴
W_G = 8.01 Kg/m
L = 2000 mm
Separación, S = 2200 mm

Celosía

A = 81.12 cm²
d = 1950.00 mm
Ix = 878299.40 cm⁴
W_G = 52.80 Kg/m
L = 24000 mm

4.4. PROPIEDADES DE MATERIALES

A. CONCRETO

Peso específico γ
Resistencia del Concreto f'_c
Módulo de Elasticidad E_c

γ = 2400 Kg/m³
 f'_c = 21 Kg/cm² 2.1 MPa
 E_c = 68109 Kg/cm²

B. ACERO

Límite de Fluencia F_y
Módulo de Elasticidad E_s

$$F_y = 3500 \text{ Kg/cm}^2$$
$$E = 2000000 \text{ Kg/cm}^2$$

4.5. DETERMINACIÓN DE FRECUENCIA NATURAL Y PESO DE PANEL DE PISO

A. LOSA DE PISO

El espesor efectivo se toma con la altura del sobre-espesor de losa de concreto, t_c más la mitad de la altura de la lámina colaborante, H_r así:

$$d_e = \frac{H_r}{2} + t_c = 84.6 \text{ mm}$$

B. ANÁLISIS MODAL PANEL DE LA VIGUETA

Tipo de Panel de Borde
Continuidad de Viguetas Viga con una sola luz

ANCHO EFECTIVO DE LA LOSA DE CONCRETO

El ancho efectivo de la losa de concreto es la mínima dimensión entre:

- a. La separación entre viguetas 2200 mm
b. El 40% de la Luz de las viguetas 800 mm

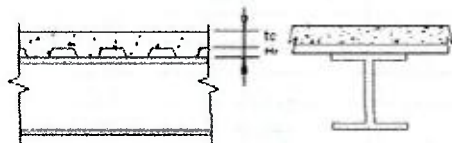
Por lo tanto: $b_{ef} = 800 \text{ mm}$

SECCIÓN TRANSFORMADA

Para considerar el aumento de rigidez a cargas dinámicas del concreto sobre una lámina metálica se aumenta su Módulo de Resistencia, E_c en un 35%.

La relación modular es: $n = \frac{E_s}{1.35 E_c} = 21.75$

El espesor usado de losa de concreto es: 59.20 mm



$\bar{y} = -34.9 \text{ mm}$
El centroide de la sección transformada está ubicado a 35 mm por encima del patín superior del perfil.

El Momento de inercia, I_t es 16518825.1 mm⁴

DEFLEXIÓN Y FRECUENCIA NATURAL DE PANEL DE VIGUETA

El peso por metro soportado por la vigueta, w_1 es 4.48 kN/m

La Deflexión máxima de la Vigueta, Δ_j es

$$\Delta_j = \frac{5w_j L_j^4}{384E_s I_j} = 0.28 \text{ mm}$$

Frecuencia Natural del Panel de Vigueta, f_j

$$f_j = 0.18 \sqrt{\frac{g}{\Delta_j}} = 33.54 \text{ Hz}$$

ANCHO EFECTIVO DE PANEL DE VIGUETA

$$B_j = C_j \left(\frac{D_s}{D_j} \right)^{1/4} L_j$$

El Coeficiente C_j para un Panel de Borde es 1.0

El momento de Inercia transformado de la losa por unidad de ancho efectivo es:

$$D_s = \frac{d^3}{12n} = 2320 \text{ mm}^3$$

El momento de Inercia transformado de la vigueta por unidad de longitud es:

$$D_j = \frac{I_j}{S} = 7509 \text{ mm}^3$$

El ancho efectivo de panel de vigueta calculado, B_j es de: **1491 mm**

* B_j no debe exceder los 2/3 del ancho de piso:

Ancho de Piso=	21000	mm
2/3 de ancho de Piso=	14000	mm

Por lo tanto:

$$B_j = 1491 \text{ mm}$$

PESO EFECTIVO DE PANEL DE VIGUETA

El peso total efectivo del panel de Vigueta, W_j es *

$$W_j = \left(\frac{w_j}{S} \right) B_j L_j = 6 \text{ kN}$$

* Como la vigueta es **Viga con una sola luz** W_j no se altera por ningún factor

C. ANÁLISIS MODAL DEL PANEL DE VIGA DE CARGA

Tipo de Conexión Viguetas-Vigas de Carga
Continuidad de Vigas de Carga

Soportadas al Alma
Viga con una sola luz

ANCHO EFECTIVO DE LA LOSA DE CONCRETO

El ancho efectivo de la losa de concreto es la mínima dimensión entre:

- a. La separación entre Vigas de Carga 2000 mm
- b. El 40% de la Luz de las Vigas de Carga 8400 mm

Por lo tanto:

$$b_{ef} = 2000 \text{ mm}$$

SECCIÓN TRANSFORMADA

Para considerar el aumento de rigidez a cargas dinámicas del concreto sobre una lámina metálica se aumenta su Módulo de Resistencia, E_c en un 35%.

La relación modular es : $n = \frac{E_s}{1.35 E_c} = 21.75$

El espesor a usar de losa de concreto es: 84.60 mm

$$\bar{y} = 464.58 \text{ mm}$$

El centroide de la sección transformada está ubicado a 464.58 mm por debajo del patín superior del perfil.

El Momento de inercia, I_g es 1.3105E+10 mm⁴

DEFLEXIÓN Y FRECUENCIA NATURAL DE PANEL DE VIGA DE CARGA

El peso por metro soportado por la viga de carga, w_g es 2.56 kN/m

La Deflexión máxima de la Vigueta, Δ_g es

$$\Delta_g = \frac{5 w_g L_g^4}{384 E_s I_g} = 2.48 \text{ mm}$$

Frecuencia Natural del Panel de Vigueta, f_g

$$f_g = 0.18 \sqrt{\frac{g}{\Delta_g}} = 11.33 \text{ Hz}$$

ANCHO EFECTIVO DE PANEL DE VIGA DE CARGA

$$B_g = C_g \left(\frac{D_j}{D_d} \right)^{1/4} L_g$$

El Coeficiente C_g para viguetas Soportadas al Alma es 1.8

El momento de Inercia transformado de la vigueta por unidad de longitud es:

$$D_j = \frac{I_j}{S} = 7509 \text{ mm}^3$$

El momento de Inercia transformado de la viga por unidad de longitud es:

$$D_g = \frac{I_g}{L_g} = 6552471 \text{ mm}^3$$

El ancho efectivo de panel de Viga de Carga inicial, B_a es: **8311 mm**

* B_j no debe exceder los 2/3 del ancho de piso:

Ancho de Piso (3 veces la luz de las Viguetas)= **6000 mm**

2/3 de ancho de Piso= **4000 mm**

Por lo tanto:

$B_a =$ **4000 mm**

PESO EFECTIVO DE PANEL DE VIGA DE CARGA

El peso total efectivo del panel de Vigüeta, W_g es *

$$W_g = \left(\frac{w_g}{L_j} \right) B_g L_g = \quad \quad \quad \mathbf{263 \quad KN}$$

* Como la viga es una Viga con una sola luz W_g no se altera por ningún factor

D. COMBINACIÓN MODAL DE PÁNELES

Para realizar la combinación modal de Páneos es necesario evaluar la relación entre la longitud de las Vigas de Carga L_g y el ancho efectivo de panel de vigüeta B_j .

$$\frac{L_g}{B_j} = \quad \quad \quad \mathbf{16.96}$$

La deflexión, Δ_g continúa siendo:

5.87 mm

FRECUENCIA NATURAL DEL SISTEMA

La frecuencia natural del sistema resulta de la combinación modal de los páneos usando la relación de Dunkerley:

$$f_n = 0.18 \sqrt{\frac{g}{(\Delta_j + \Delta_g)}} = \quad \quad \quad \mathbf{7.24 \quad Hz}$$

El peso equivalente de panel, W para la combinación modal es:

$$W = \frac{\Delta_j}{\Delta_j + \Delta_g} W_j + \frac{\Delta_g}{\Delta_j + \Delta_g} W_g = \quad \quad \quad \mathbf{255 \quad kN}$$

4.6. CHEQUEO POR VIBRACIONES DE PASO PEATONAL

Para el chequeo de vibraciones inducidas por el paso peatonal, es necesario determinar la Aceleración Máxima esperada debido a esta condición y compararla con el límite máximo de Comfort correspondiente

A. ACELERACIÓN MÁXIMA ESPERADA

Para determinar la aceleración máxima esperada debido al paso peatonal, se toman los valores recomendados de la Tabla 4.1 de la Guía de Diseño:

Grupo de Uso y Ocupacion	Po (KN)	β	a_o/g (%)
Oficinas, Residencias, Iglesias	0.29	0.02-0.05*	0.5
Centros Comerciales	0.29	0.02	1.5
Puentes Interiores	0.41	0.01	1.50
Puentes Exteriores	0.41	0.01	5

La Constante de Fuerza, Po según la Tabla 4.1 es

0.41 KN

La relación de amortiguamiento, β es por tanto:

0.01

La Aceleración Límite, a_o/g recomendada es:

1.50%

la Aceleración Máxima del piso analizado es:

$$\frac{a_p}{g} = \frac{P_o e^{-0.35 f_n}}{\beta W} = 1.27\% \text{ de } g$$

Como $1.27 < 1.5$ El Piso cumple con la Aceleración Límite

B. RIGIDEZ MÍNIMA

Si la frecuencia natural del sistema es mayor a 9 Hz, es necesario garantizar una rigidez mínima de 1 KN/mm. Como la frecuencia natural del sistema de piso es

7.24 Hz

No es necesario el requerimiento de rigidez mínima

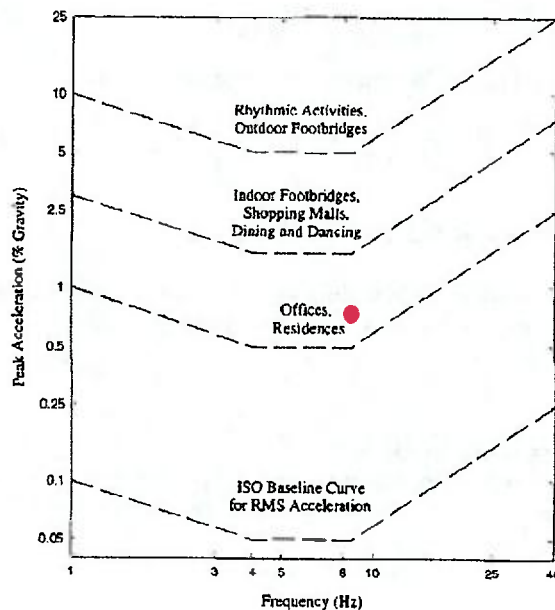


Figura 26 criterio de aceptación de la aceleración rampa 1 dentro del limite

Verificación vibraciones rampa tipo 2 y tipo 3

4. CHEQUEO DE VIBRACIONES INDUCIDAS POR ACTIVIDADES HUMANAS

4.1. ESPECIFICACIONES

GUÍA DE DISEÑO

AISC - Steel Design Guide Series
Volumen 11

USO Y OCUPACIÓN

La edificación está destinada al uso como
Actividad Rítmica Predominante

Puente Peatonal Interior
Ninguna

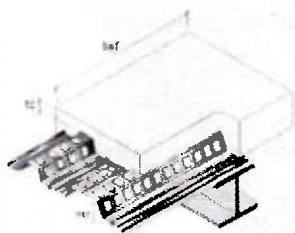
4.2. CARGA DE SERVICIO

Carga Muerta **DL**
Carga Viva **LL**
Carga de Servicio **CS**

DL = 246.93 Kg/m²
LL = 500.00 Kg/m²
CS = 746.93 Kg/m²

4.3. PROPIEDADES DE ELEMENTOS

A. STEEL DECK



Espesor de losa	Hc =	110	mm
Lámina Colaborante	Hr =	50.80	mm
Sobre-Espesor de Concreto	tc =	59.20	mm
Peso losa + lámina	Wsd =	206.93	Kg/m ²

B. VIGAS



VIGUETA IPE270

A =	45.90	cm ²
d =	270.00	mm
Ix =	5790.00	cm ⁴
WG =	36.10	Kg/m
L =	5300	mm
Separación, S =	2100	mm

VIGA CARGA IPE330 Celosía IPE330

A =	125.40	cm ²
d =	1950.00	mm
Ix =	1194080.80	cm ⁴
WG =	100.60	Kg/m
L =	23000	mm

4.4. PROPIEDADES DE MATERIALES

A. CONCRETO

Peso específico γ
Resistencia del Concreto f'_c
Módulo de Elasticidad E_c

$\gamma =$	2400	Kg/m ³	
$f'_c =$	21	Kg/cm ²	2.1 MPa
$E_c =$	68109	Kg/cm ²	

B. ACERO

Límite de Fluencia F_y
Módulo de Elasticidad E_s

$$F_y = 3500 \text{ Kg/cm}^2$$
$$E = 2000000 \text{ Kg/cm}^2$$

4.5. DETERMINACIÓN DE FRECUENCIA NATURAL Y PESO DE PANEL DE PISO

A. LOSA DE PISO

El espesor efectivo se toma con la altura del sobre-espesor de losa de concreto, t_c más la mitad de la altura de la lámina colaborante, H_r así:

$$d_e = \frac{H_r}{2} + t_c = 84.6 \text{ mm}$$

B. ANÁLISIS MODAL PANEL DE LA VIGUETA

Tipo de Panel de Borde
Continuidad de Viguetas Viga con una sola luz

ANCHO EFECTIVO DE LA LOSA DE CONCRETO

El ancho efectivo de la losa de concreto es la mínima dimensión entre:

- a. La separación entre viguetas 2100 mm
b. El 40% de la Luz de las viguetas 2120 mm

Por lo tanto:

$$b_{ef} = 2100 \text{ mm}$$

SECCIÓN TRANSFORMADA

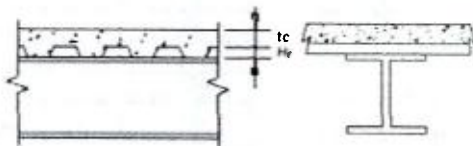
Para considerar el aumento de rigidez a cargas dinámicas del concreto sobre una lámina metálica se aumenta su Módulo de Resistencia, E_c en un 35%.

La relación modular es :

$$n = \frac{E_s}{1.35 E_c} = 21.75$$

El espesor usado de losa de concreto es:

$$59.20 \text{ mm}$$



$$\bar{y} = 15.5 \text{ mm}$$

El centroide de la sección transformada está ubicado a 16 mm por debajo del patín superior del perfil.

El Momento de inercia, I_t es

$$177679688 \text{ mm}^4$$

DEFLEXIÓN Y FRECUENCIA NATURAL DE PANEL DE VIGUETA

El peso por metro soportado por la vigueta, w_l es

$$16.05 \text{ kN/m}$$

La Deflexión máxima de la Vigueta, Δ_l es

$$\Delta_j = \frac{5w_j L_j^4}{384E_s I_j} = \quad \mathbf{4.64} \quad \mathbf{mm}$$

Frecuencia Natural del Panel de Vigueta, f_j

$$f_j = 0.18 \sqrt{\frac{g}{\Delta_j}} = \quad \mathbf{8.28} \quad \mathbf{Hz}$$

ANCHO EFECTIVO DE PANEL DE VIGUETA

$$B_j = C_j \left(\frac{D_s}{D_j} \right)^{1/4} L_j$$

El Coeficiente C_j para un Panel de Borde es 1.0

El momento de Inercia transformado de la losa por unidad de ancho efectivo es:

$$D_s = \frac{d_c^3}{12n} = \quad 2320 \quad \mathbf{mm^3}$$

El momento de Inercia transformado de la vigueta por unidad de longitud es:

$$D_j = \frac{I_j}{S} = \quad 84609 \quad \mathbf{mm^3}$$

El ancho efectivo de panel de vigueta calculado, B_j es de: $\mathbf{2157} \quad \mathbf{mm}$

* B_j no debe exceder los 2/3 del ancho de piso:

Ancho de Piso=	23000	mm
2/3 de ancho de Piso=	15333	mm

Por lo tanto:

$$B_j = \quad \mathbf{2157} \quad \mathbf{mm}$$

PESO EFECTIVO DE PANEL DE VIGUETA

El peso total efectivo del panel de Vigueta, W_j es *

$$W_j = \left(\frac{w_j}{S} \right) B_j L_j = 87 \text{ kN}$$

* Como la vigueta es **Viga con una sola luz** W_j no se altera por ningún factor

C. ANÁLISIS MODAL DEL PANEL DE VIGA DE CARGA

Tipo de Conexión Viguetas-Vigas de Carga
Continuidad de Vigas de Carga

Soportadas al Alma
Viga Continua

ANCHO EFECTIVO DE LA LOSA DE CONCRETO

El ancho efectivo de la losa de concreto es la mínima dimensión entre:

- a. La separación entre Vigas de Carga 5300 mm
- b. El 40% de la Luz de las Vigas de Carga 9200 mm

Por lo tanto:

$$b_{ef} = 5300 \text{ mm}$$

SECCIÓN TRANSFORMADA

Para considerar el aumento de rigidez a cargas dinámicas del concreto sobre una lámina metálica se aumenta su Módulo de Resistencia, E_c en un 35%.

La relación modular es :

$$n = \frac{E_s}{1.35 E_c} = 21.75$$

El espesor a usar de losa de concreto es:

$$84.60 \text{ mm}$$

$$\bar{y} = 326.69 \text{ mm}$$

El centroide de la sección transformada está ubicado a 326.69 mm por debajo del patín superior del perfil.

El Momento de inercia, I_a es

$$2.043E+10 \text{ mm}^4$$

DEFLEXIÓN Y FRECUENCIA NATURAL DE PANEL DE VIGA DE CARGA

El peso por metro soportado por la viga de carga, w_a es

$$21.26 \text{ kN/m}$$

La Deflexión máxima de la Vigueta, Δ_a es

$$\Delta_a = \frac{5 w_a L_a^4}{384 E_s I_a} = 18.95 \text{ mm}$$

Frecuencia Natural del Panel de Vigueta, f_a

$$f_a = 0.18 \sqrt{\frac{g}{\Delta_a}} = 4.09 \text{ Hz}$$

ANCHO EFECTIVO DE PANEL DE VIGA DE CARGA

$$B_g = C_g \left(\frac{D_j}{D_u} \right)^{1/4} L_g$$

El Coeficiente C_g para viguetas Soportadas al Alma es 1.8

El momento de Inercia transformado de la vigueta por unidad de longitud es:

$$D_j = \frac{I_j}{S} = 84609 \text{ mm}^3$$

El momento de Inercia transformado de la viga por unidad de longitud es:

$$D_g = \frac{I_g}{L_j} = 3854731 \text{ mm}^3$$

El ancho efectivo de panel de Viga de Carga inicial, B_a es: **15935 mm**

* B_j no debe exceder los 2/3 del ancho de piso:

Ancho de Piso (3 veces la luz de las Viguetas)= 5300 mm

2/3 de ancho de Piso= **3533 mm**

Por lo tanto:

$$B_a = \mathbf{3533 \text{ mm}}$$

PESO EFECTIVO DE PANEL DE VIGA DE CARGA

El peso total efectivo del panel de Vigueta, W_a es *

$$W_g = \left(\frac{W_g}{L_j} \right) B_g L_g = 978 \text{ KN}$$

* Como la viga es una Viga Continua W_g se multiplica por 1,5

D. COMBINACIÓN MODAL DE PÁNELES

Para realizar la combinación modal de Páneles es necesario evaluar la relación entre la longitud de las Vigas de Carga L_g y el ancho efectivo de panel de vigueta B_j .

$$\frac{L_g}{B_j} = 10.66$$

La deflexion, Δ_g continúa siendo:

$$18.95 \text{ mm}$$

FRECUENCIA NATURAL DEL SISTEMA

La frecuencia natural del sistema resulta de la combinación modal de los páneles usando la relación de Dunkerley:

$$f_n = 0.18 \sqrt{\frac{g}{(\Delta_j + \Delta_g)}} = 3.67 \text{ Hz}$$

El peso equivalente de panel, W para la combinación modal es:

$$W = \frac{\Delta_j}{\Delta_j + \Delta_g} W_j + \frac{\Delta_g}{\Delta_j + \Delta_g} W_g = 803 \text{ kN}$$

4.6. CHEQUEO POR VIBRACIONES DE PASO PEATONAL

Para el chequeo de vibraciones inducidas por el paso peatonal, es necesario determinar la Aceleración Máxima esperada debido a esta condición y compararla con el límite máximo de Comfort correspondiente

A. ACELERACIÓN MÁXIMA ESPERADA

Para determinar la aceleración máxima esperada debido al paso peatonal, se toman los valores recomendados de la Tabla 4.1 de la Guía de Diseño:

Grupo de Uso y Ocupación	Po (KN)	β	a_o/g (%)
Oficinas, Residencias, Iglesias	0.29	0,02-0,05*	0.5
Centros Comerciales	0.29	0.02	1.5
Puentes Interiores	0.41	0.01	1
Puentes Exteriores	0.41	0.01	5

La Constante de Fuerza, Po según la Tabla 4.1 es

0.41 KN

La relación de amortiguamiento, β es por tanto:

0.01

La Aceleración Límite, a_o/g recomendada es:

1.50%

la Aceleración Máxima del piso analizado es:

$$\frac{a_p}{g} = \frac{P_o e^{-0.35 f_n}}{\beta W} = 1.41\% \text{ de } g$$

Como $1.41 < 1.5$ El Piso cumple con la Aceleración Límite

B. RIGIDEZ MÍNIMA

Si la frecuencia natural del sistema es mayor a 9 Hz, es necesario garantizar una rigidez mínima de 1 KN/mm. Como la frecuencia natural del sistema de piso es

3.67 Hz

No es necesario el requerimiento de rigidez mínima

Beam	Shear Studs	Camber	Deflection	Vibration	Prices	Factors
Item				Value		
► 1	Vibration Criterion			Walking		
2	Occupancy Category			Indoor Footbridge		
3	Damping Ratio			0.01		
4	Acceleration Limit, a_0/g			0.015		

Figura 27 parámetros para verificación de vibración software de diseño

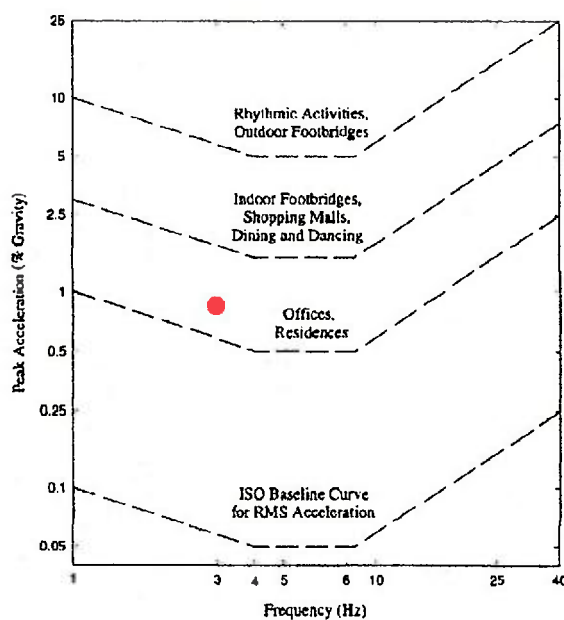


Figura 28 criterio de aceptación de la aceleración rampa 2 y 3 dentro del límite

Constructability and Serviceability Checks

	Actual	Allowable	Ratio	Pass
Constr. Dead Defl. (cm)	0.572	No Limit	N/A	N/A
Post-concrete Defl. (cm)	1.044	2.25	0.464	✓
Live Load Defl. (cm)	1.044	1.5	0.696	✓
Total Defl. (cm)	1.616	2.25	0.718	✓
Walking Acceleration a_z/g ($\beta = 0.01 P_o = 289$)	0.001882	0.015	0.125	✓

Section Properties

	PNA (cm)	Area (cm ²)	S_{top} (cm ³)	I (cm ⁴)	ΦM_n (N-cm)
Steel fully braced	13.5	45.9	428.9	5790	15016782.68
Vibrations Check ($E_c = 29100$)	3.856	234.5	N/A	23547.7	N/A

Vibration Frequency Values

Element	L (cm)	b_{eff} (cm)	Loading	I_{eff} (cm ⁴)	D (cm ³ /cm)	B (cm)	W (N)	Δ (cm)	f_n (Hz)
Slab	540	216	0.274+0.019N/cm ²	2188.6	2188.6/216	2218			
Beam	540	216	65.07N/cm	23547.7	23547.7/222	2300.21	195033.22	0.15	14.53
Panel							95033.22	0.15	14.53

Figura 29 reporte diseño servicio por vibraciones y deflexión rampa tipo 2

Constructability and Serviceability Checks

	Actual	Allowable	Ratio	Pass
Constr. Dead Defl. (cm)	0.331	No Limit	N/A	N/A
Post-concrete Defl. (cm)	0.613	1.542	0.397	✓
Live Load Defl. (cm)	0.613	1.028	0.596	✓
Total Defl. (cm)	0.944	1.542	0.612	✓
Walking Acceleration a_p/g ($\beta = 0.01 P_o = 289$)	0.000175	0.015	0.012	✓

Section Properties

	PNA (cm)	Area (cm ²)	S_{bot} (cm ³)	I (cm ⁴)	ΦM_o (N-cm)
Steel fully braced	10	28.5	194.3	1943	6856836.72
Vibrations Check ($E_s = 29100$)	5.91	136.2	N/A	11290.4	N/A

Vibration Frequency Values

Element	L (cm)	b_{eff} (cm)	Loading	I_{eff} (cm ⁴)	D (cm ² /cm)	B (cm)	W (N)	Δ (cm)	f_n (Hz)
Slab	370.001	148	0.27+0.019N/cm ²	2163.6	2163.6/148	1994.961			
Beam	370	148	57.2N/cm	11290.4	11290.4/197.506	2*263.117	1*56388.34	0.061	22.812
Panel							56388.34	0.061	22.812

Figura 30 reporte diseño servicio por vibraciones y deflexión rampa tipo 3

Constructability and Serviceability Checks

	Actual	Allowable	Ratio	Pass
Constr. Dead Defl. (cm)	0.089	No Limit	N/A	N/A
Post-concrete Defl. (cm)	0.145	1.246	0.116	✓
Live Load Defl. (cm)	0.145	0.83	0.174	✓
Total Defl. (cm)	0.234	1.246	0.188	✓
Walking Acceleration a_p/g ($\beta = 0.01 P_o = 289$)	0.000007	0.015	4.461E-04	✓

Section Properties

	PNA (cm)	Area (cm ²)	S_{bot} (cm ³)	I (cm ⁴)	ΦM_o (N-cm)
Steel fully braced	9	23.9	146.3	1317	5150384.14
Vibrations Check ($E_s = 29100.33509$)	1.715	67.4	N/A	5658.6	N/A

Vibration Frequency Values

Element	L (cm)	b_{eff} (cm)	Loading	I_{eff} (cm ⁴)	D (cm ² /cm)	B (cm)	W (N)	Δ (cm)	f_n (Hz)
Slab	2092.804	59.794	0.308+0.019+0.053N/cm ²	453.6	453.6/59.794	770.021			
Beam	298.972	59.794	28.48N/cm	5658.6	5658.6/75	1*168.35	1*19115.58	0.026	35.224
Panel							19115.58	0.026	35.224

Figura 31 reporte diseño servicio por vibraciones y deflexión rampa tipo 4

5 DISEÑO ESTRUCTURAL.

Para el diseño de los elementos estructurales se suponen los efectos ortogonales de la fuerza sísmica representada por el espectro, suponiendo la ocurrencia simultánea del 100% de la fuerza sísmica en una dirección y el 30% de la fuerza sísmica en la dirección perpendicular.

En la metodología utilizada se modela tridimensionalmente la estructura con el programa computacional con esto se obtienen las fuerzas de corte, momentos flectores y fuerzas axiales, una vez realizado el análisis estructural, el programa diseña automáticamente el refuerzo en los elementos de concreto y se chequea, considerando las diferentes combinaciones de carga con los respectivos factores de mayoración de carga y reducción de resistencia del NSR10, que son iguales a los del AC1318. Una vez realizado el análisis estructural, las respuestas máximas modales incluyendo las deflexiones, derivas y esfuerzos se comparan con los admisibles especificados por el NSR-10.

Después de realizado el análisis estructural, se procede al diseño del refuerzo requerido según lo especificado en el NSR-10. El refuerzo se diseña con los momentos flectores alrededor del eje respectivo según sea el caso para vigas y columnas (M11, M22, M12 y V13, V23 arrojados por el programa).

En el diseño de la cimentación se usará zapatas individuales, con vigas de amarre, cuantificando los esfuerzos cortantes mayorados V_u , ocasionados por las reacciones del terreno, los cuales se comparan con el esfuerzo cortante admisible en el concreto ϕv_c por funcionamiento, por aplastamiento y longitud de anclaje. La fuerza cortante generalmente es la que determina el espesor, aunque inicialmente se diseña por flexión. De igual manera se evalúan los momentos flectores, se supone una cuantía de 0.0020 y se calcula la altura, se compara el acero obtenido con el mínimo para flexión y se suministra el requerido para construcción, retracción de fraguado y temperatura. Después se revisa la longitud de anclaje. La resistencia de diseño que tiene un elemento y cualquier parte o sección de él, en términos de momento flector, carga axial, cortante y torsión, debe ser igual a:

Resistencia de diseño < Resistencia Nominal > Resistencia Requerida

Los coeficientes de reducción de resistencia utilizados son:

Flexión: $\phi = 0.9$

Compresión Axial: $\phi = 0.65$

Cortante y Torsión: $\phi = 0.75$

El diseño a flexión requiere unas cuantías mínimas especificadas en el NSR-10.

En el Cap. C.7.12 especifica que se debe colocar refuerzo para retracción de fraguado y variación de temperatura perpendicular al refuerzo principal para losas macizas en una dirección. La relación de área de refuerzo a área bruta de concreto debe tener como mínimo una cuantía de 0.0018 para barras corrugadas con $f_y = 420$ MPa.

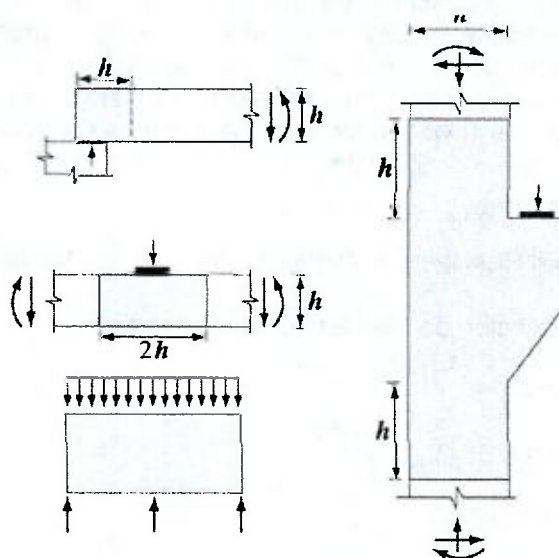
Para $f'_c = 21$ MPa y $f_y = 420$ MPa se obtiene una cuantía mínima de 0.0033

La distancia libre entre barras paralelas colocadas en una fila, no debe ser menor que el diámetro de la barra d_b , $s > d_b$, o $s > 25 \text{ mm}$ o $s > 1.33$ veces el tamaño del agregado grueso. (Cap. C.7.6)

Las barras del refuerzo deben tener el recubrimiento mínimo según sea el caso, para concreto colocado directamente sobre el suelo y en contacto permanente con la tierra el recubrimiento mínimo debe ser 75 mm y 50 mm para concreto no expuesto a la intemperie ni en contacto permanente con la tierra para todos los tipos de refuerzo en vigas, columnas y zapatas. Para estribos el recubrimiento mínimo debe ser de 30 ms. (Cap. C.7.7, NSR-10).

6.1 DISEÑO DE APOYOS DE CONCRETO REGIONES D

"Discontinuidad — La discontinuidad en la distribución de esfuerzos se produce en el cambio de geometría de un elemento estructural o en una carga o reacción concentrada. El principio de Saint Venant señala que los esfuerzos debidos a cargas axiales y flexión se acercan a una distribución lineal a una distancia aproximadamente igual a la altura total del elemento, h , medida desde la discontinuidad. Por esta razón, se supone que las discontinuidades se extienden una distancia h desde la sección donde se produce la carga o el cambio de geometría. La figura C-RA.1.1(a) muestra las discontinuidades geométricas típicas, y la figura C-RA.1.1(b) muestra las discontinuidades geométricas y de cargas combinadas."



(b) Discontinuidades geométricas y de carga

C.11.8.1 — Se puede utilizar el Apéndice C-A en el diseño de ménsulas y cartelas con una relación de luz de cortante a altura, av/d , menor que 2. Se puede diseñar ménsulas y cartelas utilizando C.11.8.3 y C.11.8.4, cuando:

(a) av/d , no mayor que 1, y

- (b) Cuando están sometidas a una fuerza mayorada de tracción horizontal, N_{uc} no mayor que V_u

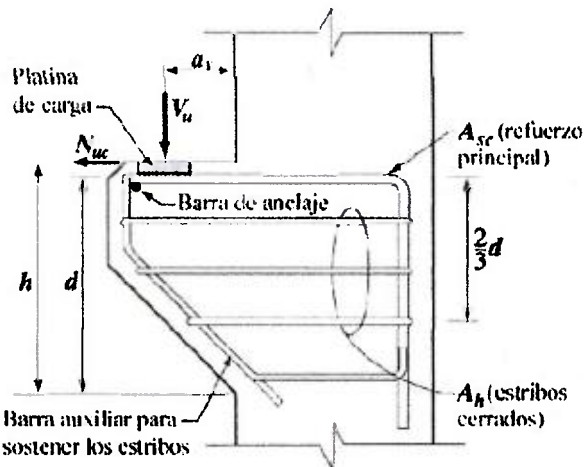
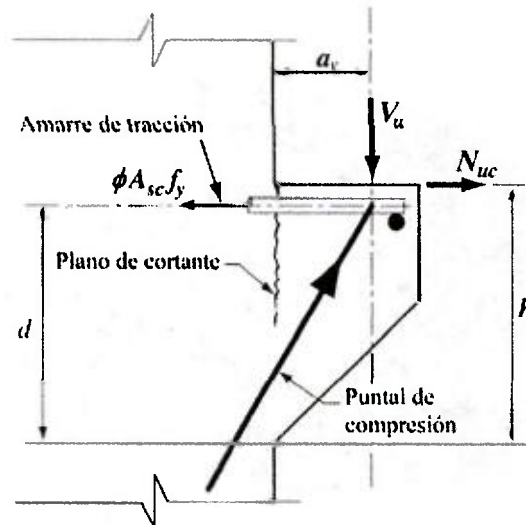


Fig. CR11.8.2 — Notación empleada en 11.8

C.11.8.4 — El área total, A_h , de estribos cerrados o estribos paralelos al refuerzo principal de tracción no debe ser menos que $0.5 (A_{sc} - A_n)$ * A_h debe distribuirse uniformemente dentro de los $2/3d$ adyacentes al refuerzo principal de tracción.

Diseño de ménsulas cortas en vigas de anclaje de rampas

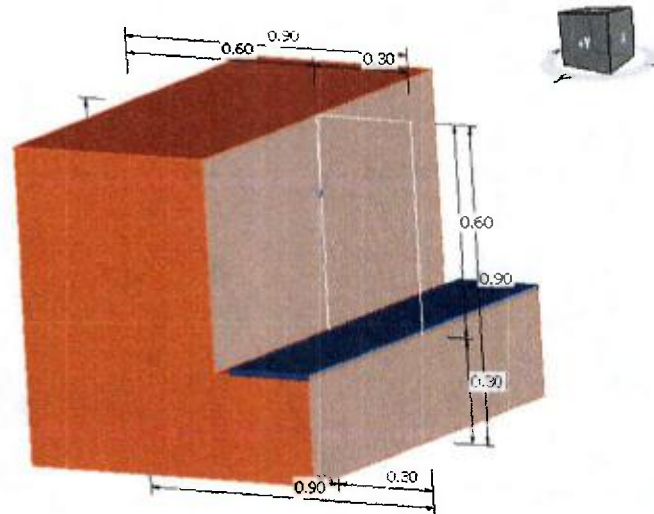


Figura 32 detalle viga ménsula

Materials

Concrete

Name	f_c' [MPa]	E [MPa]
4000 psi	27.6	24866.0

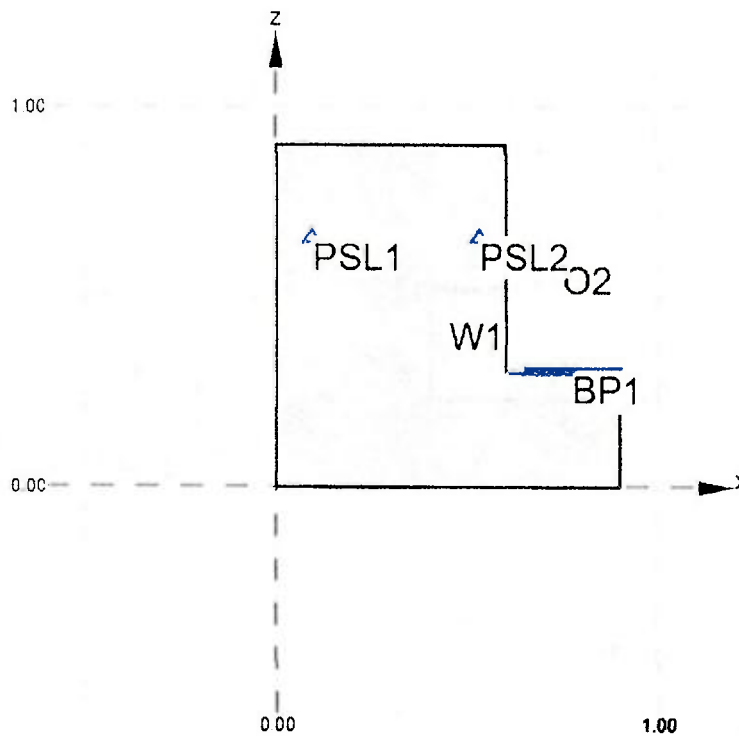
Reinforcement

Name	f_y [MPa]	E [MPa]	Unit mass [kg/m ³]
Grade 60	413.7	199938.0	7850
$\epsilon_{st} = 1000.0 \cdot 1e-4, \epsilon_{sc} = 1000.0 \cdot 1e-4,$			

Steel

Name	E [MPa]
A572 Gr.50	200000.0

Geometry

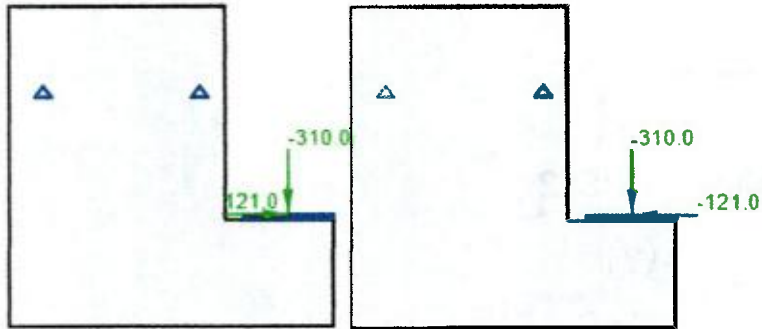


Overview table

Name	Type	Properties	Position
W1	Wall	Rectangular; W: 0.90 m; H: 0.90 m; T: 1.20 m; Material: 4000 psi	
O2	Opening	Rectangular; W: 0.30 m; H: 0.60 m	M: W1; IP: 3; MP: 3
BP1	Bearing plate	W: 0.25 m; T: 0.02 m; Material: A572 Gr.50	M: W1, Edge 5; From beginning; X: 0.13 m
PSL1	Patch support	X; Z; α : 0.0 °; r: 0.07 m	M: W1; MP: 0; X: -0.27 m; Z: 0.27 m
PSL2	Patch support	X; Z; α : 0.0 °; r: 0.07 m	M: W1; MP: 0; X: 0.17 m; Z: 0.27 m

Loads

LC1, LC2



Load case LC1 - Permanent

Point loads

Name	Q [kN]	Direction	Master	Position [X;Z]
PI1	-310.0	Global Z	BP1	-
PI2	121.0	Global X	BP1	-

Load case LC2 - Permanent

Point loads

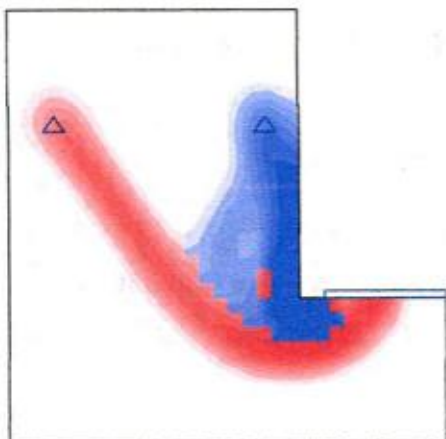
Name	Q [kN]	Direction	Master	Position [X;Z]
PI3	-121.0	Global X	BP1	-
PI4	-310.0	Global Z	BP1	-

Combination

Name	Type	Content
C1	ULS	LC1
C2	SLS - Crack width	LC1
C3	SLS - Deflection	LC1
C4	SLS - Crack width + Deflection	LC1
C5	ULS	LC2
C6	SLS - Crack width	LC2
C7	SLS - Deflection	LC2
C8	SLS - Crack width + Deflection	LC2

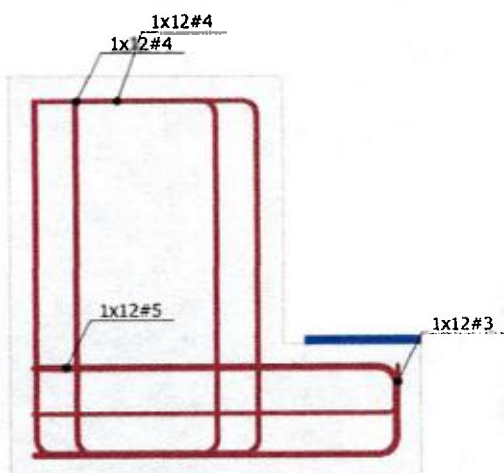
Topology optimization

Topology optimization: C8, Effective volume 0.2



Reinforcement

Scheme of reinforcement



Concrete: 4000 psi, Steel: Grade 60

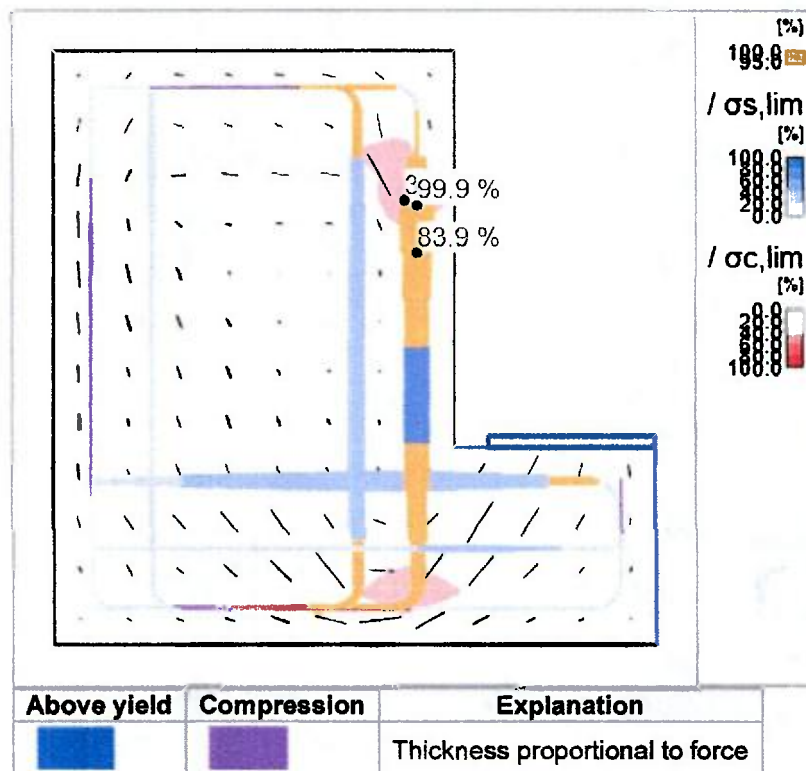
Results Summary

Overview table

Check item	Combination	Increment	Item			
ULS	C5	P100.0%, V100.0%	Anchorage length			
Check item	Item	Utilization				
Strength of concrete	W1	$\sigma_c/\sigma_{c,lim}$: 35.8%				
Strength of reinforcement	GB3	$\epsilon_s/\epsilon_{s,lim}$: 1.2%, $\sigma_s/\sigma_{s,lim}$: 83.9%				
Anchorage length	GB3	τ_b/f_{bd} : 99.9%				
SLS	C6 (LT)	P100.0%, V100.0%	Crack width			
Check item	Combination	Increment	Critical check	Item	Utilization	
Crack width	C6 (LT)	P100.0%, V100.0%	w/wlim	GB3	61.1%	

ULS - Summary

Stress flow



Summary of reactions and applied loads: C5, Load increment: P100.0%, V100.0%

Type	F_x [kN]	F_z [kNm]	M_y [kNm]
Summary of reactions	121.0	310.0	202.2
Summary of applied load	-121.0	-310.0	-202.1
Check of equilibrium	0.0	0.0	0.0

ULS - Strength

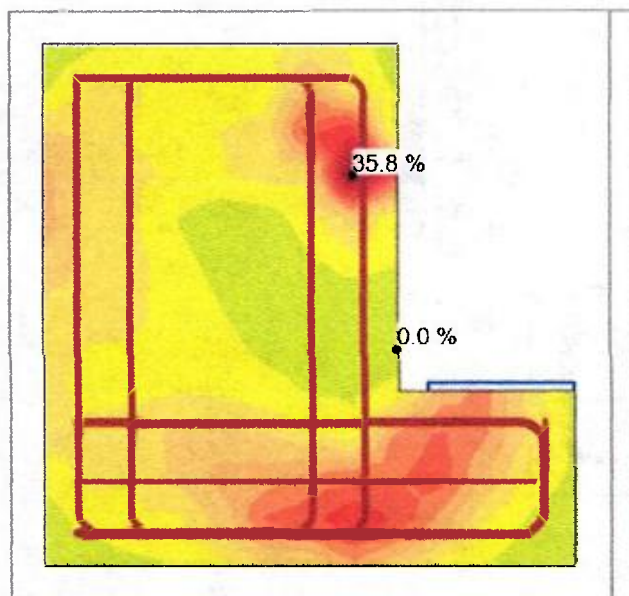
Detailed concrete strength results: C5, Load increment: P100.0%, V100.0%

Member	X [m]	Z [m]	σ_c [MPa]	ϵ_c [1e-4]	k_{c2} [-]	$\sigma_c/\sigma_{c,lim}$ [%]	
W1	0.53	0.68	-5.3	-3.6	0.90	35.8	OK
W1	0.60	0.75	0.0	0.0	0.59	0.0	OK

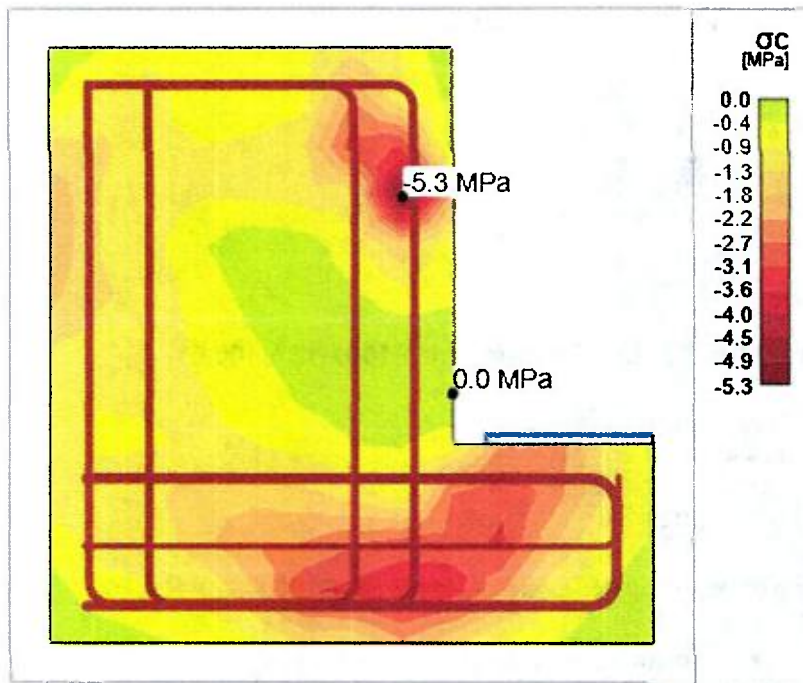
Detailed reinforcement strength results: C5, Load increment: P100.0%, V100.0%

Member	X [m]	Z [m]	σ_s [MPa]	ϵ_s [1e-4]	$\sigma_s/\sigma_{s,lim}$ [%]	$\epsilon_s/\epsilon_{s,lim}$ [%]	
GB3	0.54	0.59	312.5	11.7	83.9	1.2	OK
GB2	0.45	0.23	146.8	3.1	39.4	0.3	OK
GB1	0.53	0.25	117.6	2.2	31.6	0.2	OK
GB4	0.61	0.14	102.5	0.8	27.5	0.1	OK

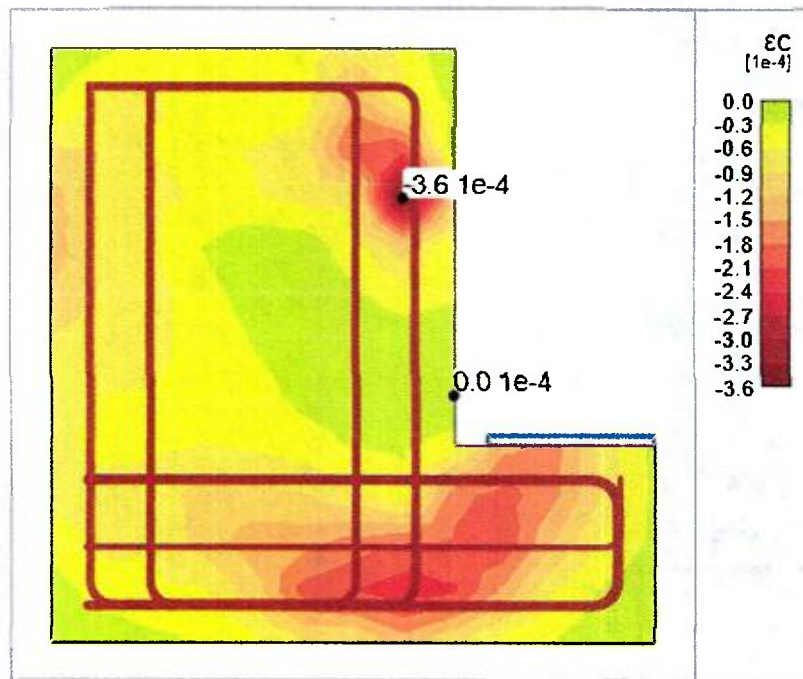
Concrete stress/strength ratio



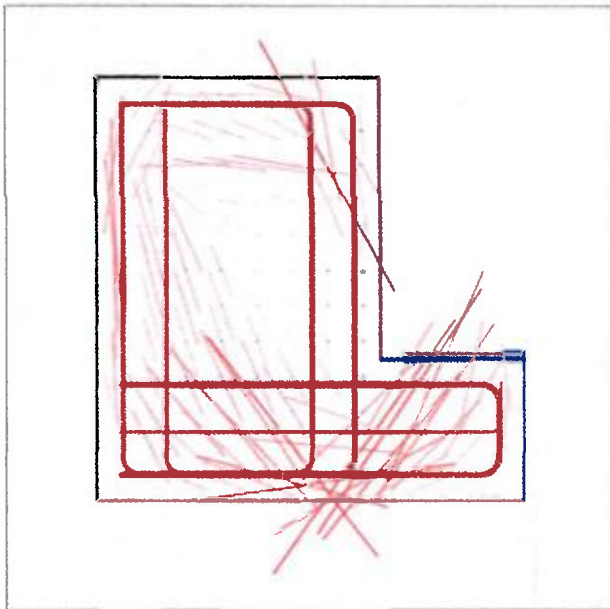
Concrete principal stress σ_c



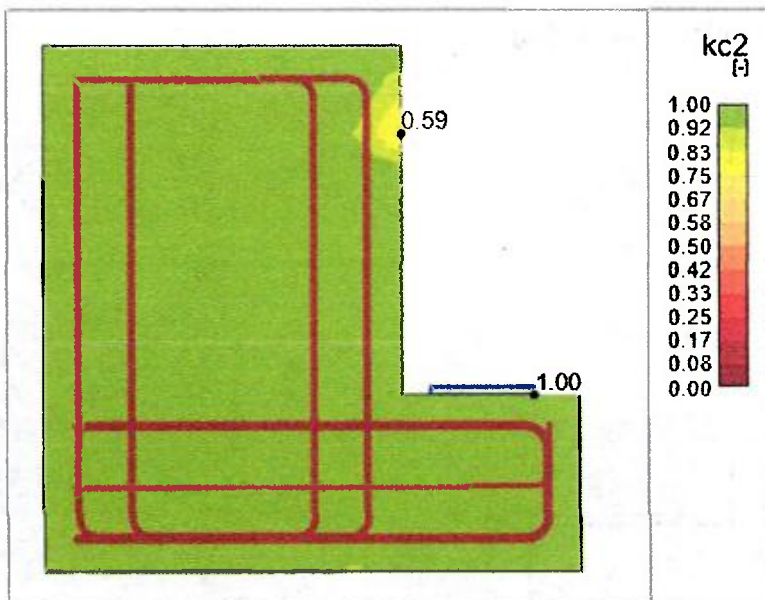
Concrete principal strain ϵ_c



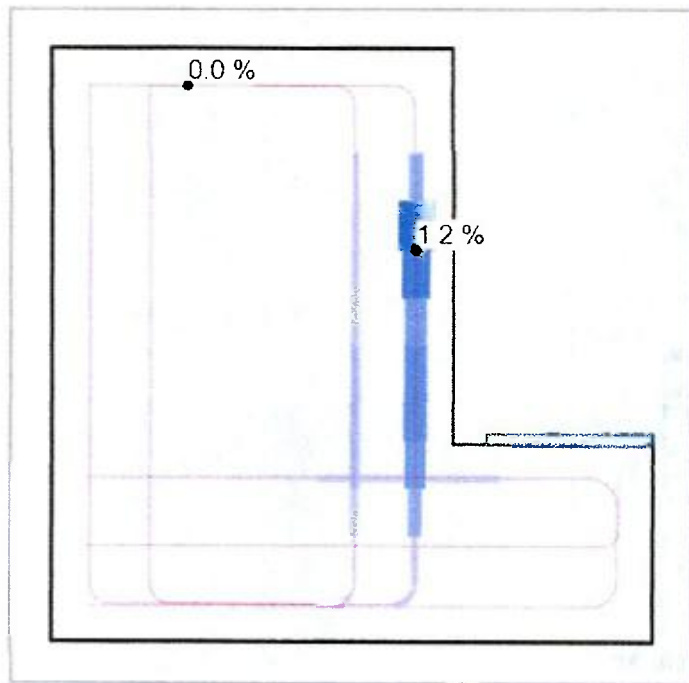
Directions of principal stresses



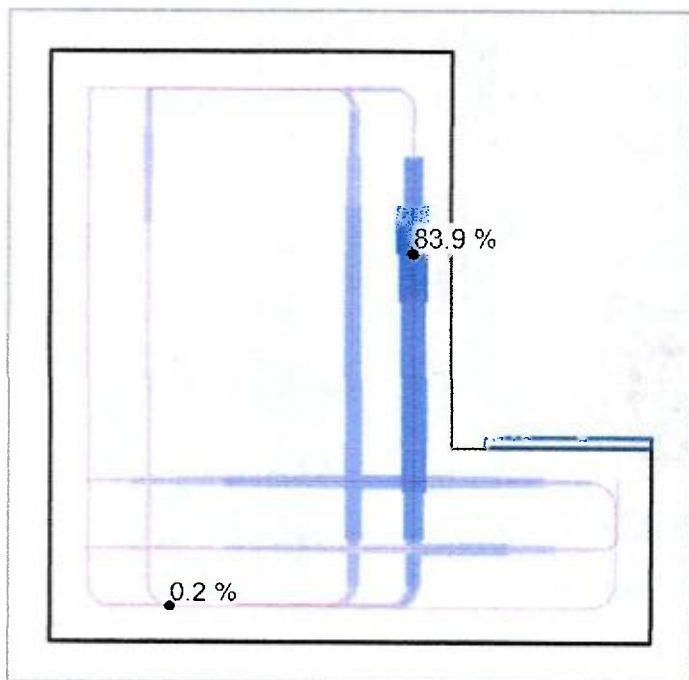
Compressive strength reduction factor k_{c2}



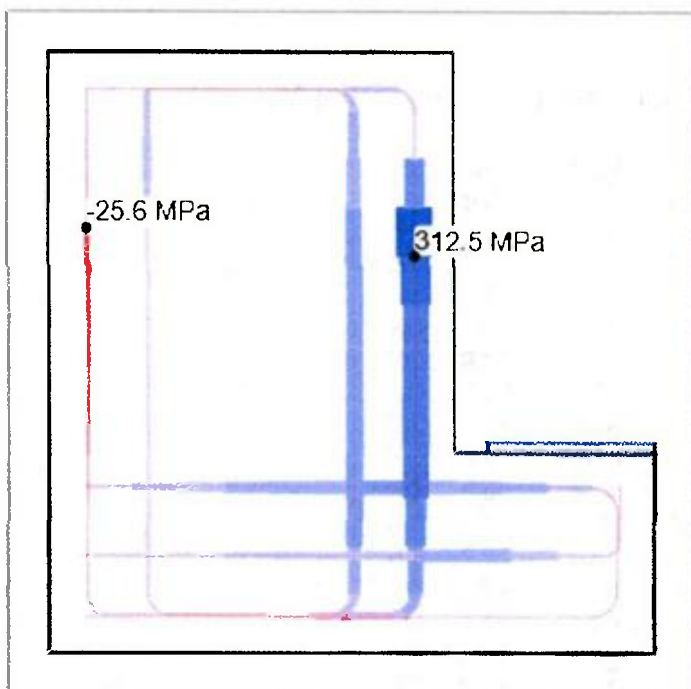
Reinforcement strain/limit strain ratio - $\varepsilon_s/\varepsilon_{s,lim}$ [%]



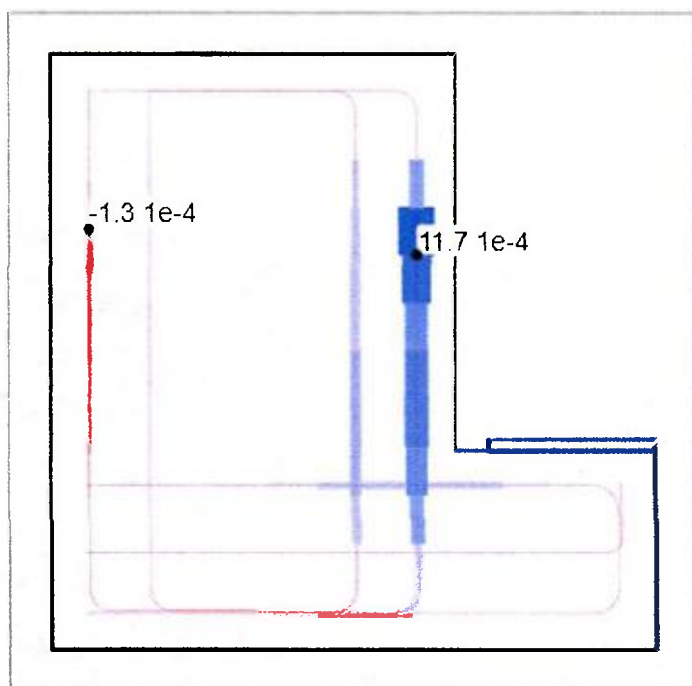
Reinforcement stress/strength ratio - $\sigma_s/\sigma_{s,lim}$ [%]



Reinforcement stress - σ_s [MPa]



Reinforcement strain - ϵ_s [1e-4]

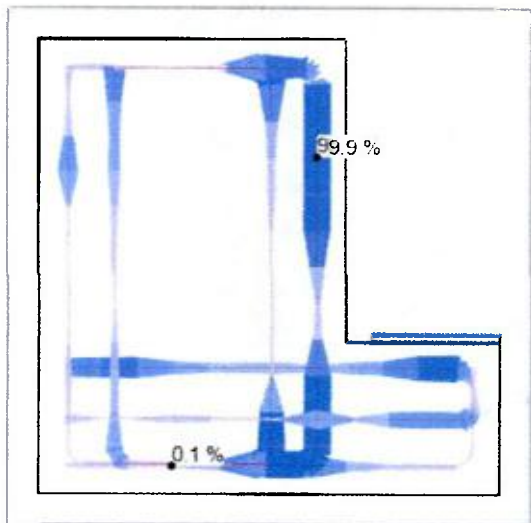


ULS - Anchorage

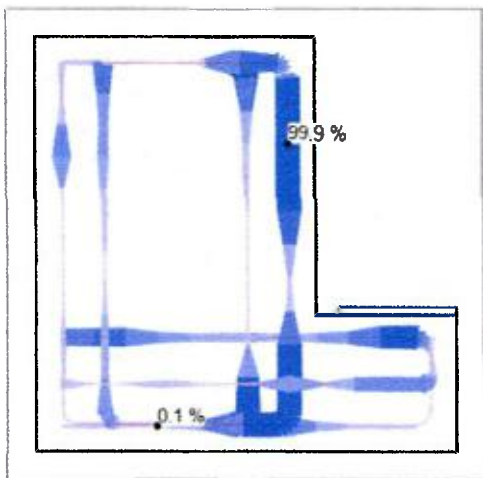
Detailed anchorage results: C5, Load increment: P100.0%, V100.0%

Member	X [m]	Z [m]	τ_b [MPa]	F_a [kN]	F_{tot} [kN]	F_{tot}/F_{lim} [%]	τ_b/f_{bd} [%]	
GB3	0.54	0.67	2.1	44.1	475.0	83.9	99.9	OK
GB3	0.54	0.81	-2.1	44.1	37.0	6.5	99.9	OK
GB3	0.54	0.59	2.1	44.1	475.0	83.9	99.9	OK
GB3	0.29	0.84	0.0	44.1	-4.8	0.8	1.7	OK
GB2	0.45	0.81	-2.1	15.3	133.0	23.5	99.9	OK
GB2	0.44	0.07	2.1	15.3	101.8	18.0	99.9	OK
GB2	0.45	0.23	0.0	15.3	223.1	39.4	1.9	OK
GB2	0.06	0.64	1.6	15.3	-39.0	6.9	74.5	OK
GB1	0.81	0.25	2.1	59.1	109.5	12.4	99.9	OK
GB1	0.19	0.25	-1.3	59.1	182.1	39.0	77.8	OK
GB1	0.53	0.25	0.4	59.1	279.2	37.9	22.7	OK
GB1	0.40	0.05	-0.8	59.1	-44.7	5.1	47.1	OK
GB1	0.33	0.25	-0.5	59.1	215.1	40.2	31.4	OK
GB4	0.83	0.15	-1.7	13.1	15.6	8.3	80.4	OK
GB4	0.54	0.14	1.5	13.1	55.0	17.3	70.2	OK
GB4	0.61	0.14	0.3	13.1	87.6	27.5	11.8	OK
GB4	0.85	0.21	-0.1	13.1	-2.1	0.6	3.5	OK

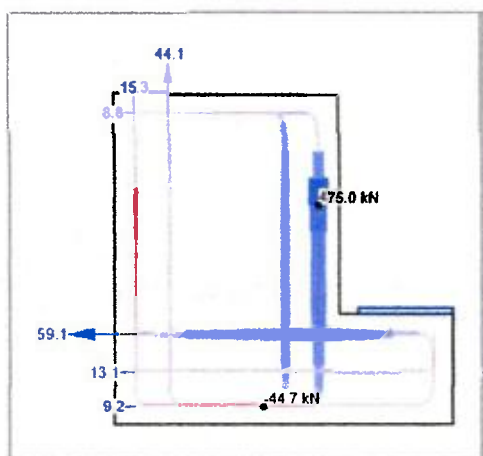
Bond stress check value - τ_b/f_{bd} [%]



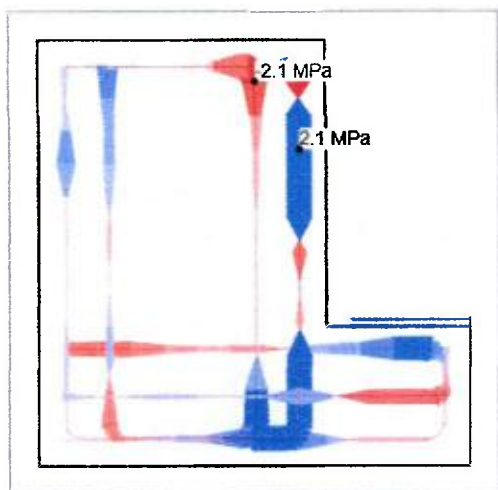
Force check value - F_{tot}/F_{lim} [%]



Total force in the bar - F_{tot} [kN]



Bond stress - τ_b [MPa]



Settings

Creep coefficient

Type of input	Creep coefficient
Input by user	2.5

SLS - Crack

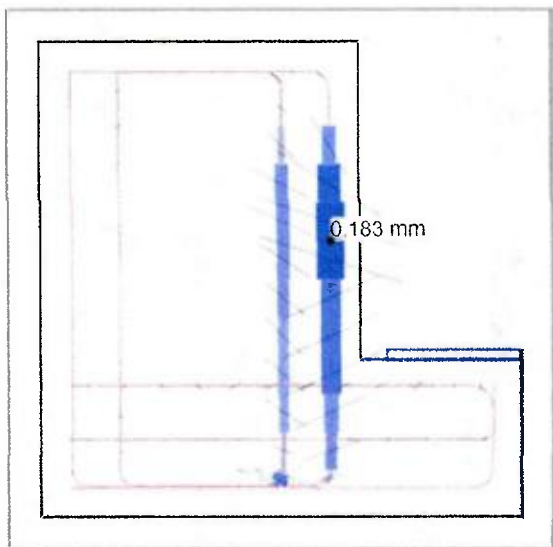
Detailed crack results: C6, Load increment: P100.0%, V100.0%, $w_{lim}=0.300$ mm

Member	X [m]	Z [m]	w [mm]	w/ w_{lim} [%]	
GB3	0.54	0.52	0.183	61.1	OK
GB2	0.44	0.07	0.103	34.3	OK
GB1	0.74	0.25	0.018	6.1	OK
GB4	0.83	0.14	0.014	4.5	OK

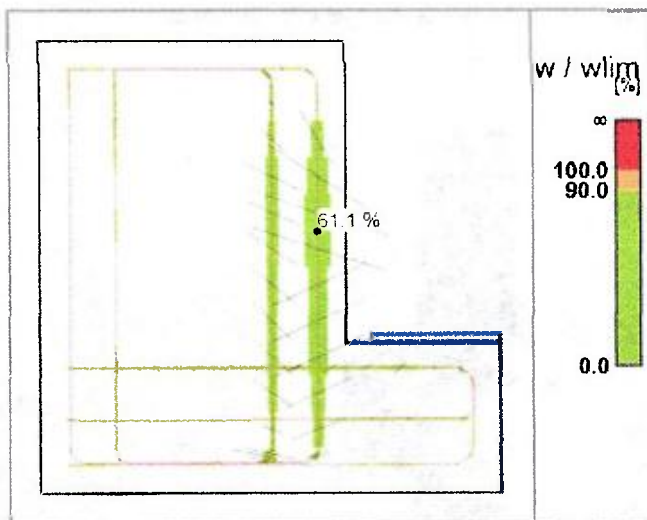
Intermediate crack results

Member	ϵ_{cm} [1e-4]	ϵ_m [1e-4]	s_r [mm]	Φ [mm]	ρ_{eff} [%]	w_b [mm]	θ_r [-]	θ_b [-]
GB3	0.0	7.5	258	13	1.21	0.194	2.81	1.57
GB2	0.0	8.6	132	13	2.34	0.113	2.92	0.92
GB1	0.0	1.0	250	16	1.56	0.025	0.82	0.00
GB4	0.0	0.8	242	10	0.97	0.020	0.87	0.13

Crack width - w [mm]



Crack width check

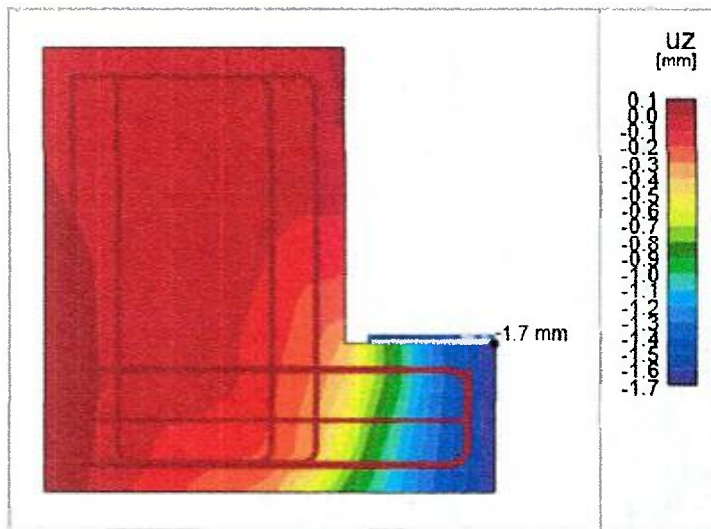


SLS - Deflection

Detailed deflection results: C3, Load increment: P100.0%, V100.0%

Member	X [m]	Z [m]	u _{z,st} [mm]	u _{z,lt} [mm]	Δu _z [mm]	u _z [mm]	
W1	0.90	0.30	-1.3	-1.7	0.0	-1.7	OK
W1	0.90	0.23	-1.3	-1.7	0.0	-1.7	OK

Deflection



Diseño de ménsulas cortas en columnas de anclaje de rampas

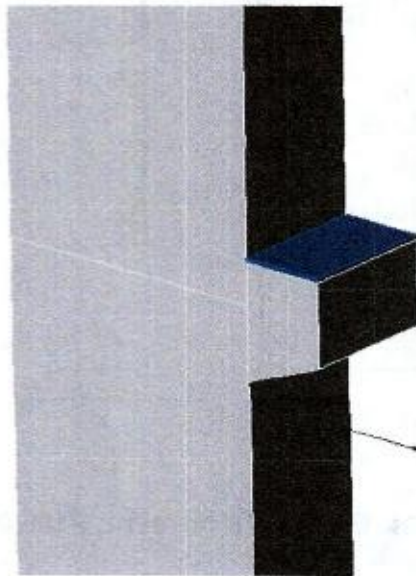


Figura 33 detalle ménsulas cortas columnas

Materials

Concrete

Name	f_c' [MPa]	E [MPa]	
5000 psi	34.5	27801.1	
	5000 psi	27.6	24866.0

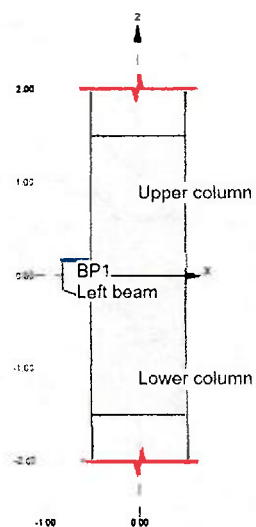
Reinforcement

Name	f_y [MPa]	E [MPa]	Unit mass [kg/m ³]
Grade 60	413.7	199938.0	7850
	$E_{st} = 1000.0 \cdot 1e-4, E_{sc} = 1000.0 \cdot 1e-4,$		

Steel

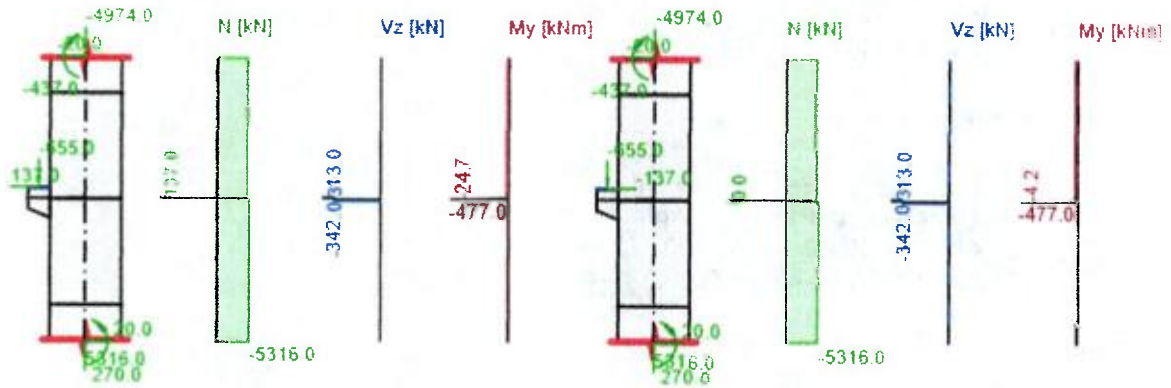
Name	E [MPa]
A572 Gr. 50	200000.0

Geometry



Loads

LE2, LE1



Load case LE2 - Permanent

Internal forces in supports or sections

Member	Position	N [kN]	Vz [kN]	My [kNm]
Lower column	2.00 m (Left)	-5316.0	20.0	-230.0
Upper column	0.00 m (Right)	-4974.0	20.0	-477.0
Left beam	0.80 m (Left)	0.0	-342.0	-247.0

Point loads

Name	Q [kN]	Direction	Master	Position [X;Z]
PI1	-655.0	Global Z	BP1	-
PI2	137.0	Global X	BP1	-

Load case LE1 - Permanent

Internal forces in supports or sections

Member	Position	N [kN]	Vz [kN]	My [kNm]
Lower column	2.00 m (Left)	-5316.0	20.0	-230.0
Upper column	0.00 m (Right)	-4974.0	20.0	-477.0
Left beam	0.80 m (Left)	0.0	-342.0	-247.0

Point loads

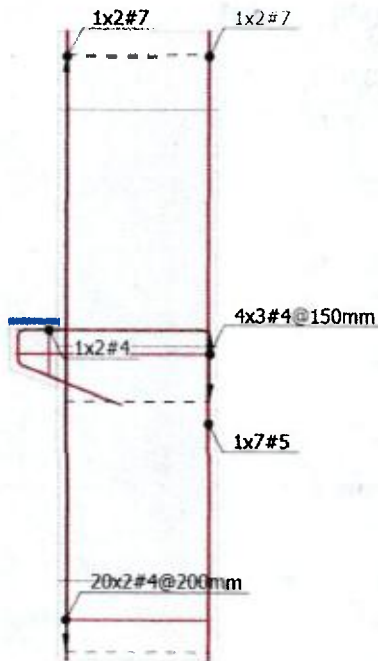
Name	Q [kN]	Direction	Master	Position [X;Z]
PI3	-655.0	Global Z	BP1	-
PI4	-137.0	Global X	BP1	-

Combination

Name	Type	Content
C1	ULS	LE2
C2	SLS - Deflection	LE2
C3	SLS - Crack width	LE2
C4	SLS - Crack width + Deflection	LE2
C5	ULS	LE1
C6	SLS - Deflection	LE1
C7	SLS - Crack width	LE1
C8	SLS - Crack width + Deflection	LE1

Reinforcement

Scheme of reinforcement



Concrete: 5000 psi; Steel: Grade 60

Results

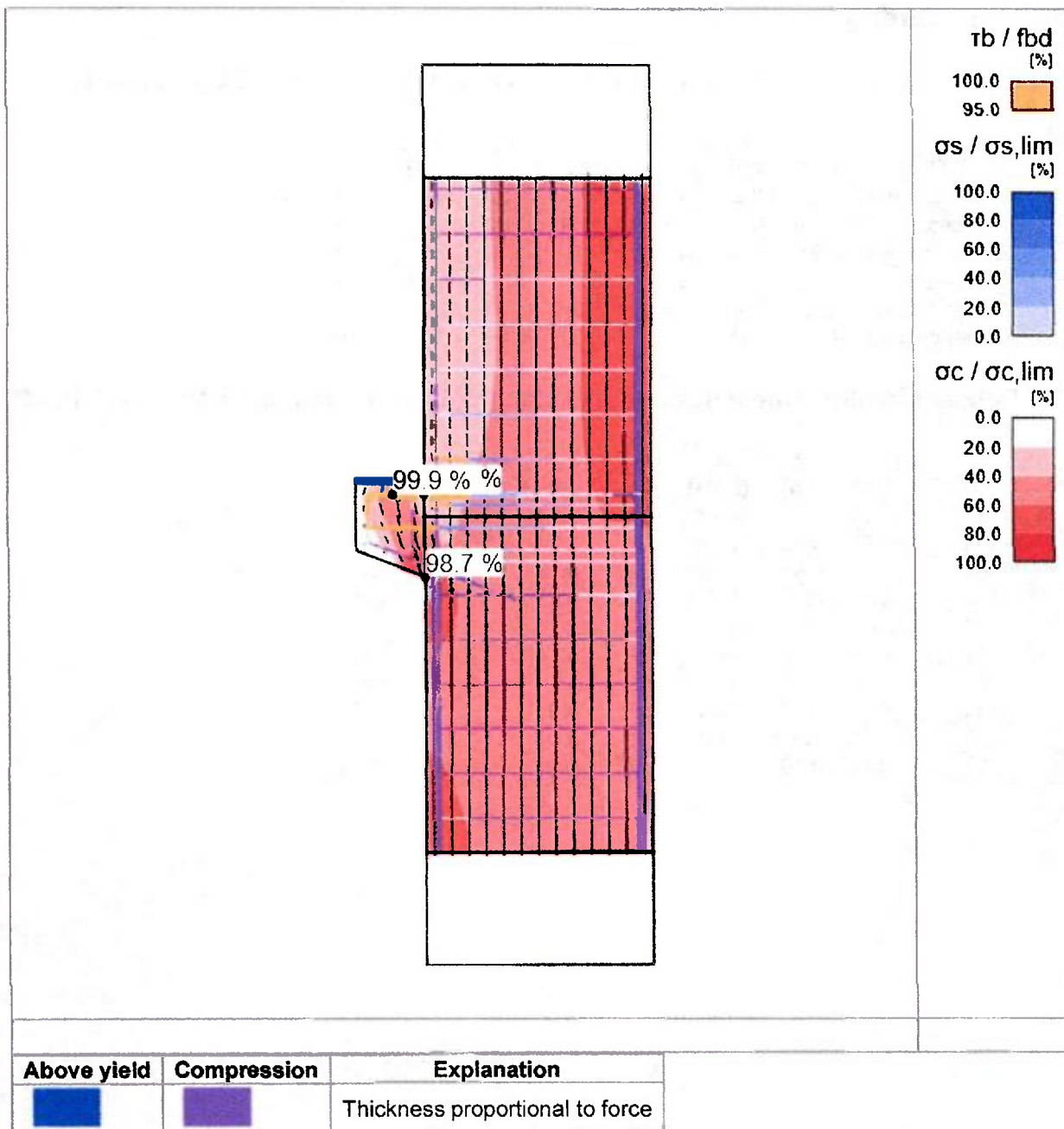
Summary

Overview table

Check item	Combination	Increment	Item			
ULS	C5	P100.0%, V100.0%	Strength of concrete			
Check item		Item	Utilization			
Strength of concrete		Lower column	$\sigma c/\sigma c,lim: 98.7\%$			
Strength of reinforcement		GB3	$\epsilon s/\epsilon s,lim: 1.1\%, \sigma s/\sigma s,lim: 76.4\%$			
Anchorage length		GB4	$rb/fbd: 99.9\%$			
SLS	C7 (LT)	P100.0%, V100.0%	Crack width			
Check item	Combination	Increment	Critical check	Item	Utilization	
Crack width	C7 (LT)	P100.0%, V100.0%	w/wlim	GB3	97.3%	

ULS - Summary

Stress flow



Summary of reactions and applied loads: C5, Load increment: P100.0%, V100.0%

Type	F _x [kN]	F _z [kNm]	M _y [kNm]
------	------------------------	-------------------------	-------------------------

Summary of reactions	137.0	313.0	-201.3
Summary of applied load	-137.0	-313.0	201.4
Check of equilibrium	0.0	0.0	0.0

ULS - Strength

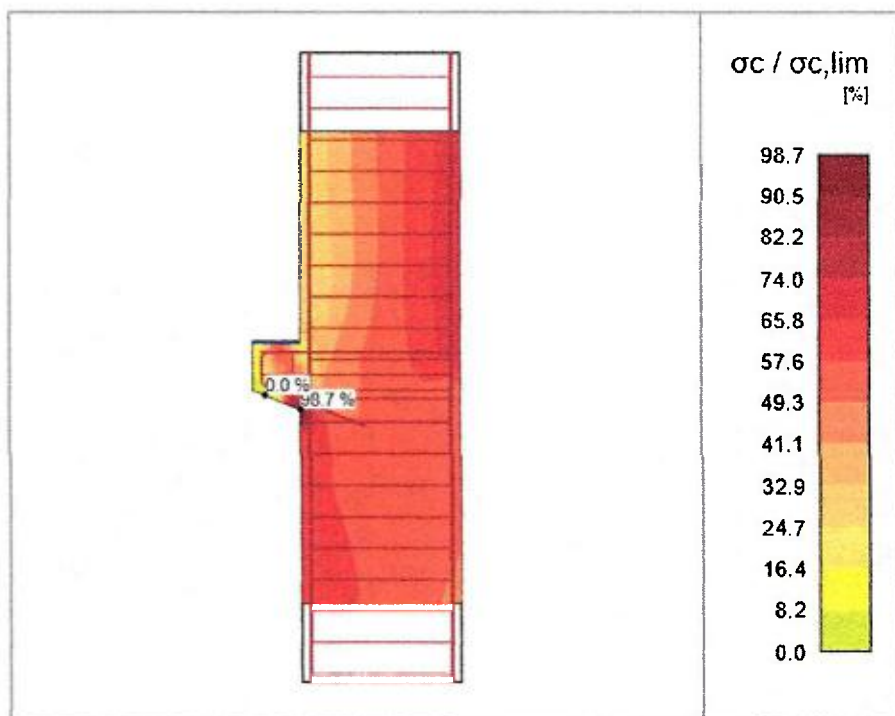
Detailed concrete strength results: C5, Load increment: P100.0%, V100.0%

Member	X [m]	Z [m]	σ_c [MPa]	ϵ_c [1e-4]	k_{c2} [-]	$\sigma_c/\sigma_{c,lim}$ [%]	
Lower column	-0.50	-0.27	-19.5	-17.3	1.00	98.7	OK
Left beam	-0.58	-0.24	-16.5	-11.4	1.00	83.4	OK
Upper column	0.50	0.30	-14.3	-9.1	1.00	72.3	OK
Left beam	-0.58	0.08	-9.4	-5.4	0.91	52.4	OK
Lower column	0.50	-1.42	-9.4	-5.3	1.00	47.7	OK
Upper column	-0.50	0.15	-0.7	-0.3	0.69	4.8	OK

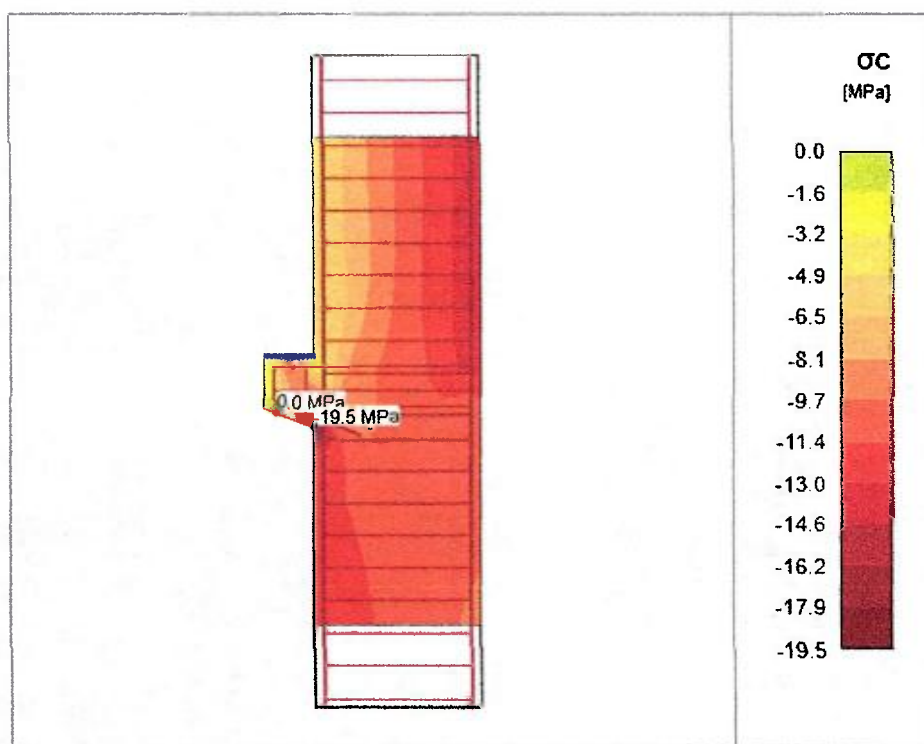
Detailed reinforcement strength results: C5, Load increment: P100.0%, V100.0%

Member	X [m]	Z [m]	σ_s [MPa]	ϵ_s [1e-4]	$\sigma_s/\sigma_{s,lim}$ [%]	$\epsilon_s/\epsilon_{s,lim}$ [%]	
GB3	-0.50	0.10	284.4	11.4	76.4	1.1	OK
GB4	-0.50	0.10	235.4	9.5	63.2	0.9	OK
GB1	0.44	0.64	-174.1	-8.7	46.8	0.9	OK
GB2	-0.44	-0.43	-153.9	-7.7	41.3	0.8	OK
GB1	0.44	-1.50	-106.6	-5.3	28.6	0.5	OK
ST1	-0.37	0.05	199.0	3.9	53.4	0.4	OK
ST1	-0.45	0.25	235.0	3.8	63.1	0.4	OK
GB2	-0.44	0.07	-16.0	-0.8	4.3	0.1	OK
ST2	-0.55	-0.05	-11.3	-0.6	3.0	0.1	OK
ST2	-0.55	0.10	1.1	0.0	0.3	0.0	OK

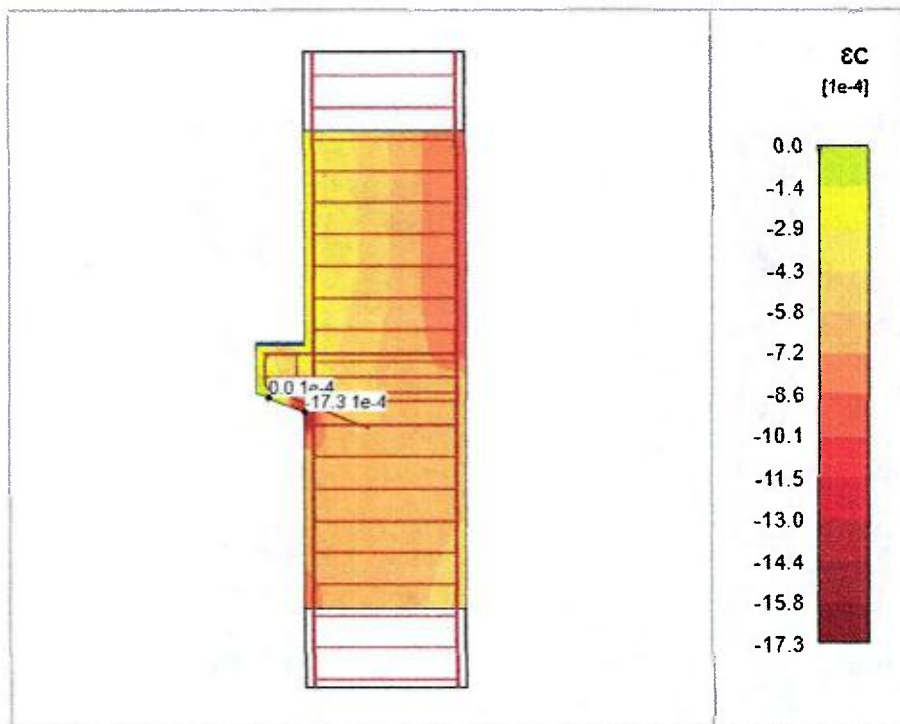
Concrete stress/strength ratio



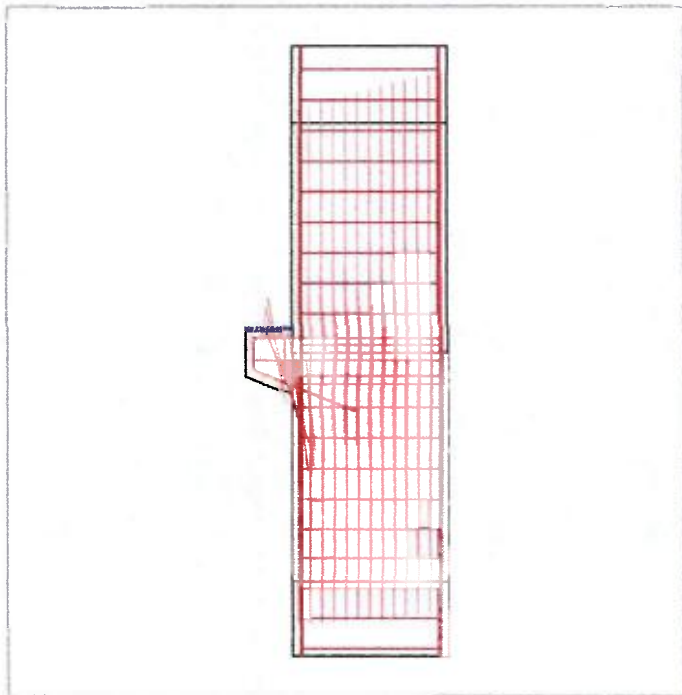
Concrete principal stress σ_c



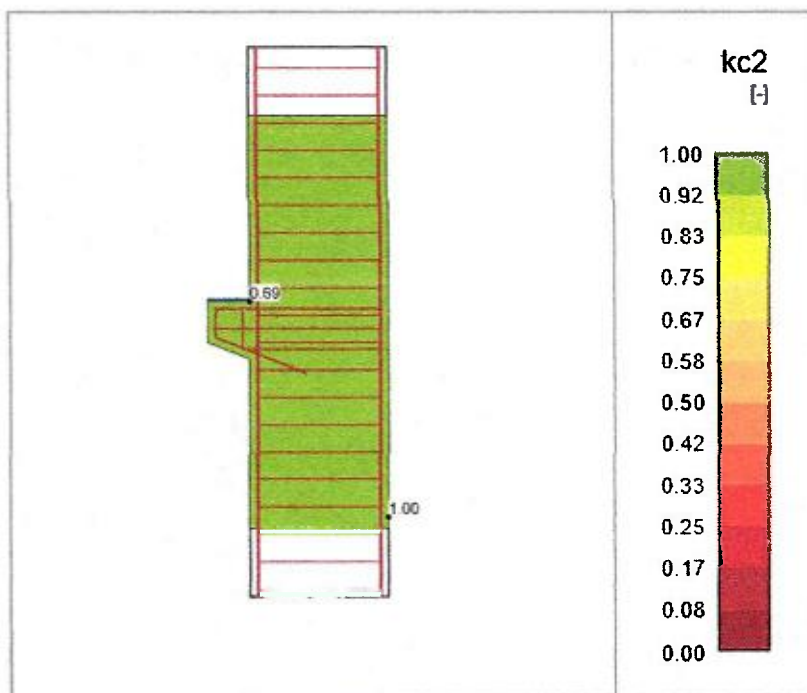
Concrete principal strain ϵ_c



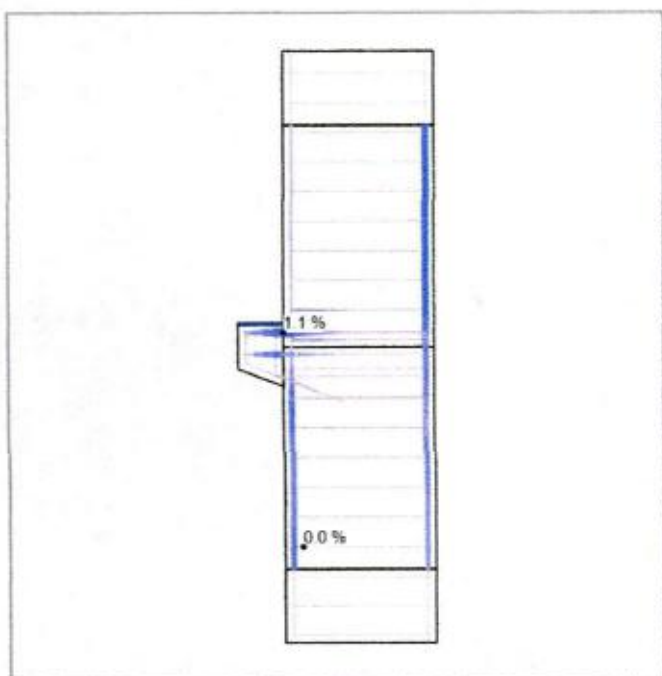
Directions of principal stresses



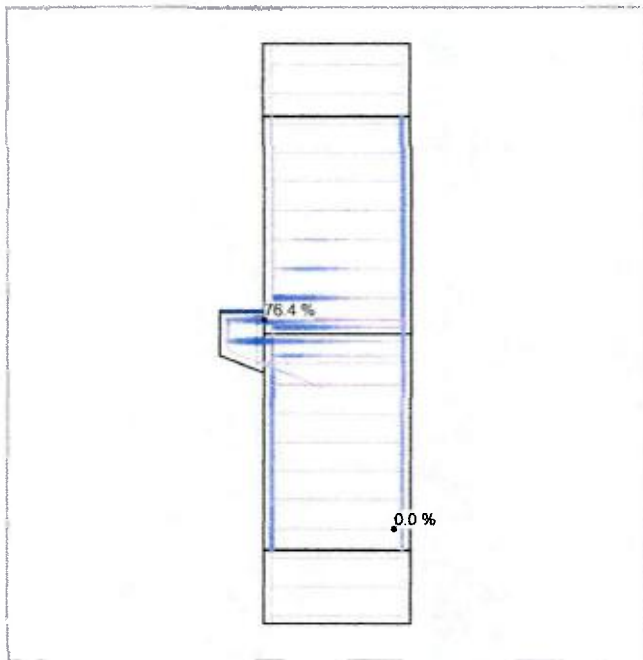
Compressive strength reduction factor k_{c2}



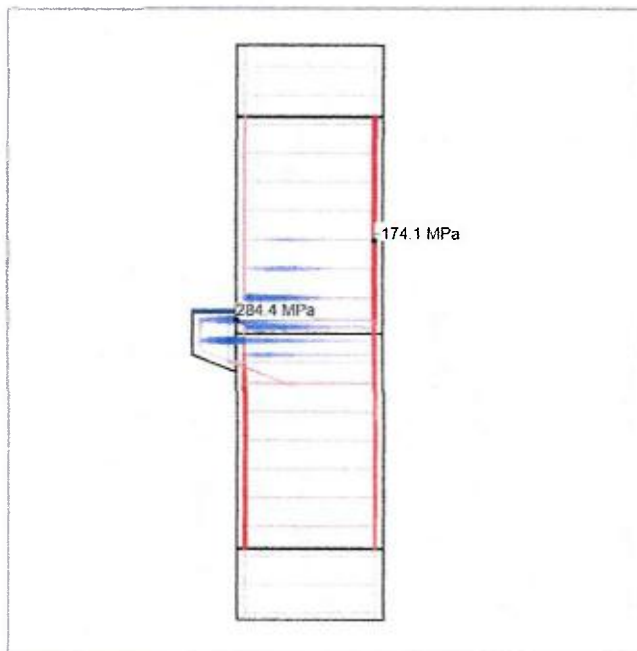
Reinforcement strain/limit strain ratio - $\epsilon_s/\epsilon_{s,lim}$ [%]

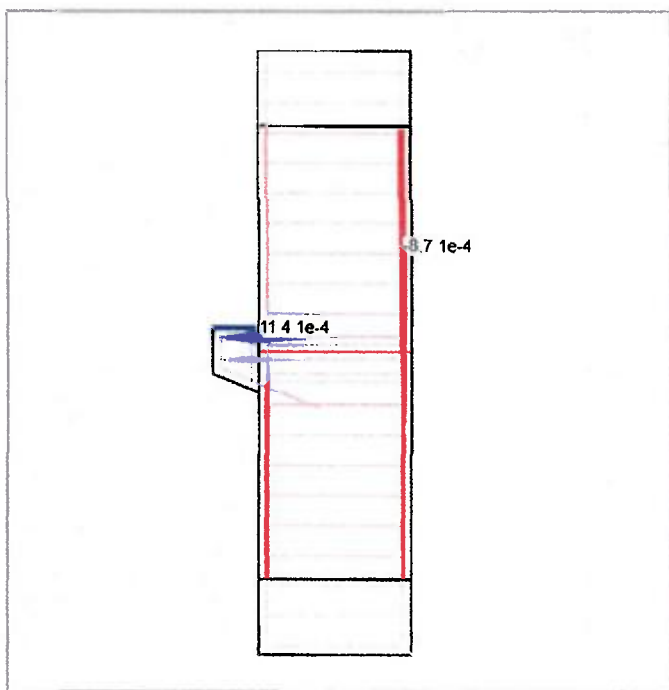


Reinforcement stress/strength ratio - $\sigma_s/\sigma_{s,lim}$ [%]



Reinforcement stress - σ_s [MPa]



Reinforcement strain - ϵ_s [1e-4]

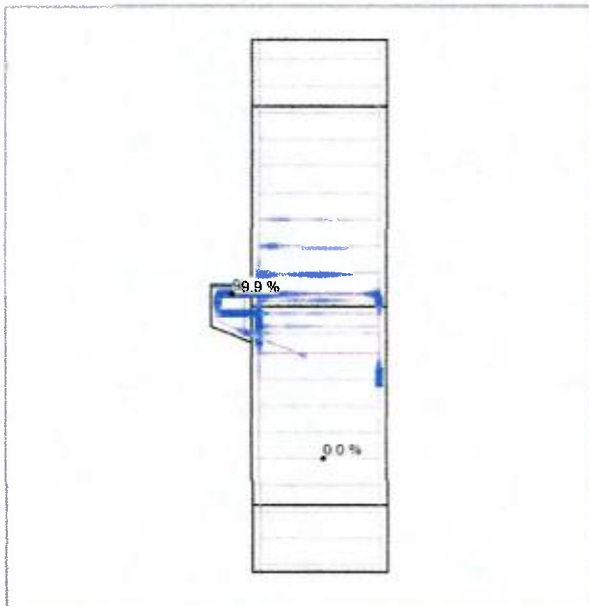
ULS - Anchorage

Detailed anchorage results: C5, Load increment: P100.0%, V100.0%

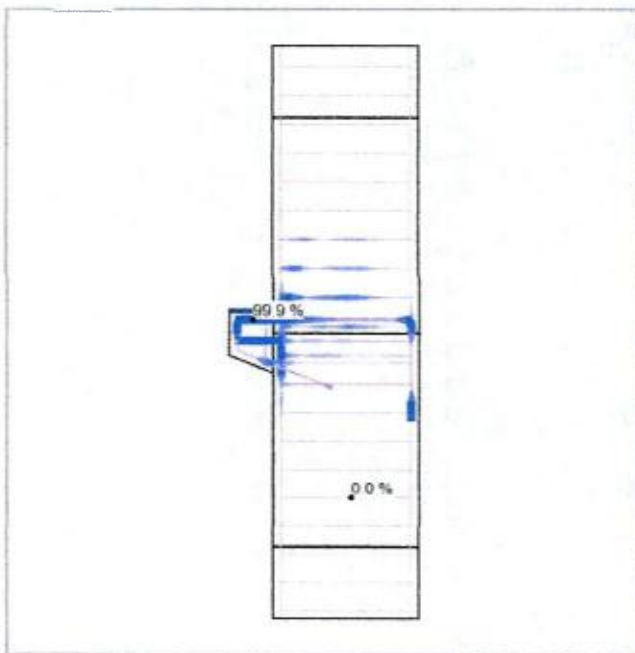
Member	X [m]	Z [m]	T_b [MPa]	F_a [kN]	F_{tot} [kN]	F_{tot}/F_{lim} [%]	T_b/f_{bd} [%]	
GB4	-0.64	0.10	2.4	0.0	171.4	33.2	99.9	OK
GB4	-0.43	0.10	-2.4	0.0	326.2	63.2	99.9	OK
GB4	-0.50	0.10	2.4	0.0	326.2	63.2	99.9	OK
GB4	0.45	-0.07	-0.3	0.0	-174.4	33.8	10.9	OK
GB3	-0.43	0.10	-2.4	44.7	108.1	76.4	99.9	OK
GB3	-0.63	0.10	2.4	44.7	66.1	46.7	99.9	OK
GB3	-0.50	0.10	2.4	44.7	108.1	76.4	99.9	OK
GB3	-0.39	-0.35	-0.4	44.7	-8.2	5.8	17.9	OK
ST1	-0.45	0.25	2.4	56.1	59.5	63.1	99.9	OK
ST1	-0.37	0.25	-2.4	56.1	59.5	63.1	99.9	OK
ST1	-0.38	-0.35	-0.4	56.1	-5.5	5.8	14.7	OK
GB2	-0.44	-0.21	1.9	0.0	-94.0	32.6	99.9	OK
GB2	-0.44	0.21	-1.5	0.0	-13.0	4.5	77.5	OK
GB2	-0.44	0.07	0.8	0.0	-12.4	4.3	42.6	OK
GB2	-0.44	-0.43	-0.7	0.0	-119.4	41.3	33.8	OK
GB1	0.44	0.07	-1.2	0.0	-115.8	40.1	62.5	OK
GB1	0.44	-0.50	0.3	0.0	-94.2	32.6	14.9	OK
GB1	0.44	-1.50	-0.1	0.0	-82.7	28.6	2.9	OK
GB1	0.44	0.64	0.0	0.0	-135.1	46.8	0.1	OK

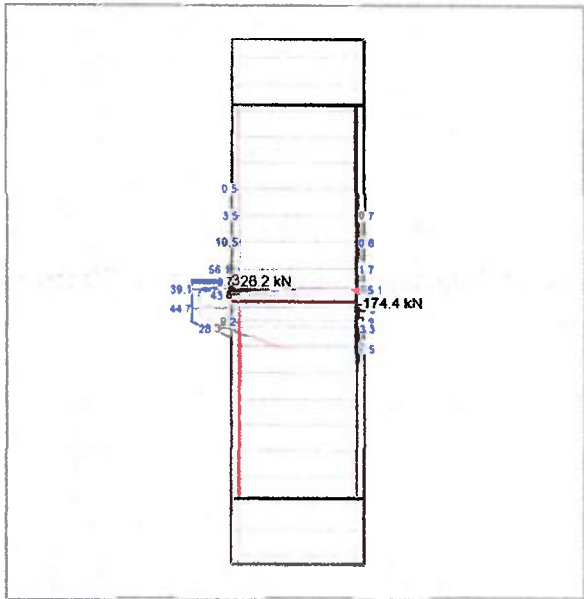
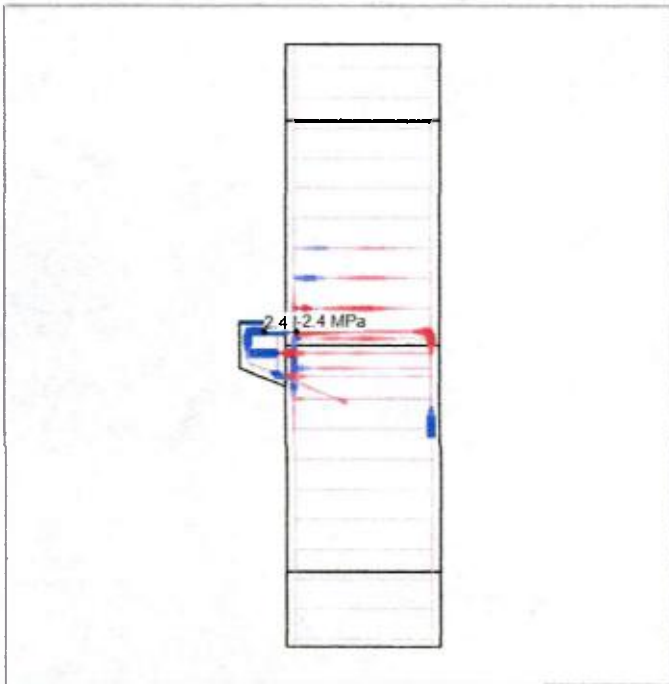
ST2	-0.55	-0.12	0.6	0.7	-2.9	3.0	24.0	OK
ST2	-0.55	0.03	-0.6	0.7	0.3	0.3	23.5	OK
ST2	-0.55	0.10	0.1	0.7	0.3	0.3	2.4	OK
ST2	-0.55	-0.05	-0.2	0.7	-2.9	3.0	8.9	OK

Bond stress check value - T_b/f_{bd} [%]



Force check value - F_{tot}/F_{lim} [%]



Total force in the bar - F_{tot} [kN]**Bond stress - τ_b [MPa]**

Settings

Creep coefficient

Type of input	Creep coefficient
Input by user	2.5

SLS - Crack

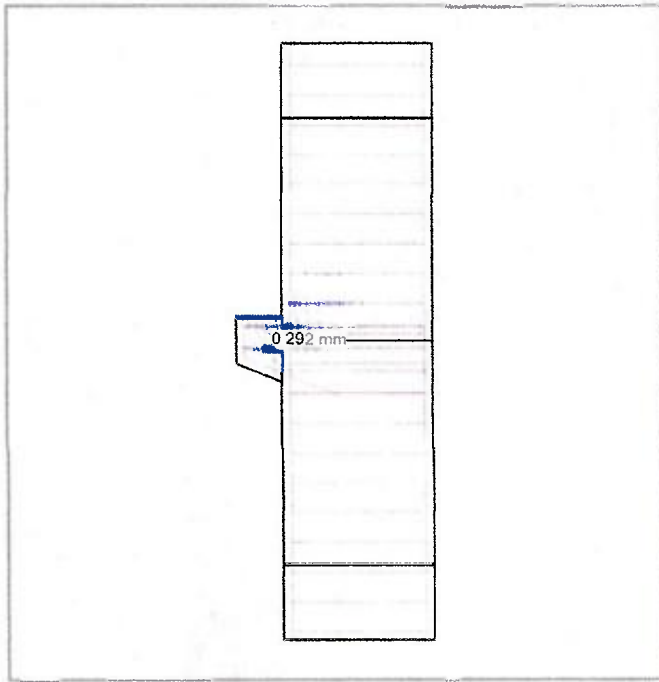
Detailed crack results: C7, Load increment: P100.0%, V100.0%, $w_{lim}=0.300$ mm

Member	X [m]	Z [m]	w [mm]	w/w _{lim} [%]	
GB3	-0.56	-0.05	0.292	97.3	OK
GB4	-0.50	0.10	0.229	76.2	OK
ST1	-0.45	0.25	0.172	57.5	OK
ST2	-0.55	0.10	0.000	0.0	OK
GB1	0.44	-2.00	0.000	0.0	OK
GB2	-0.44	-2.00	0.000	0.0	OK

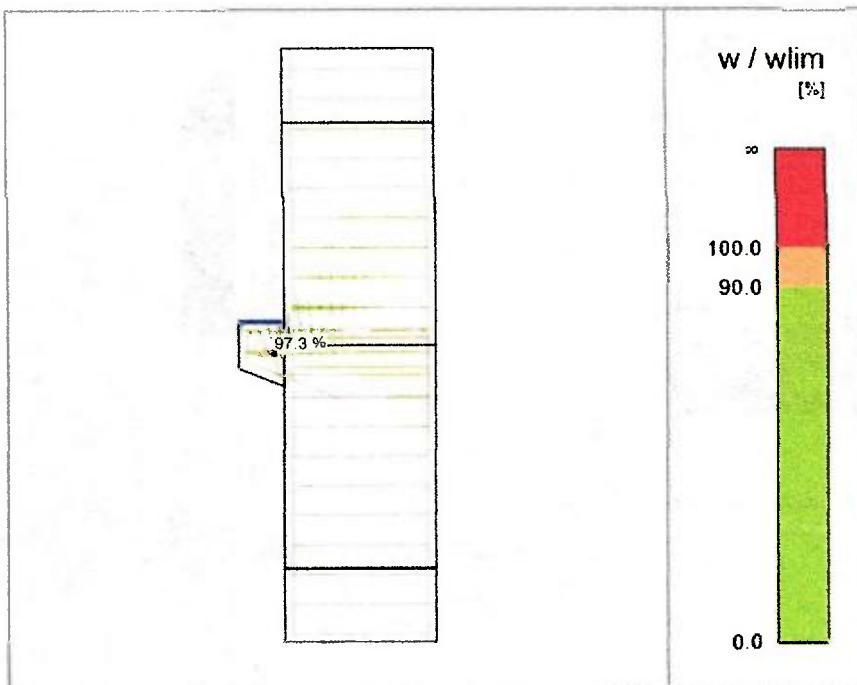
Intermediate crack results

Member	ϵ_{cm} [1e-4]	ϵ_m [1e-4]	s_r [mm]	Φ [mm]	ρ_{eff} [%]	w_b [mm]	θ_r [-]	θ_b [-]
GB3	0.0	9.5	347	13	0.91	0.328	2.04	0.00
GB4		11.4		16	2.23	0.231	1.70	0.00
ST1		4.4		13	0.91	0.173	1.66	0.00
ST2	0.0	0.0	0	0	0.00	0.000	0.00	0.00
GB1	0.0	0.0	0	0	0.00	0.000	0.00	0.00
GB2	0.0	0.0	0	0	0.00	0.000	0.00	0.00

Crack width - w [mm]



Crack width check

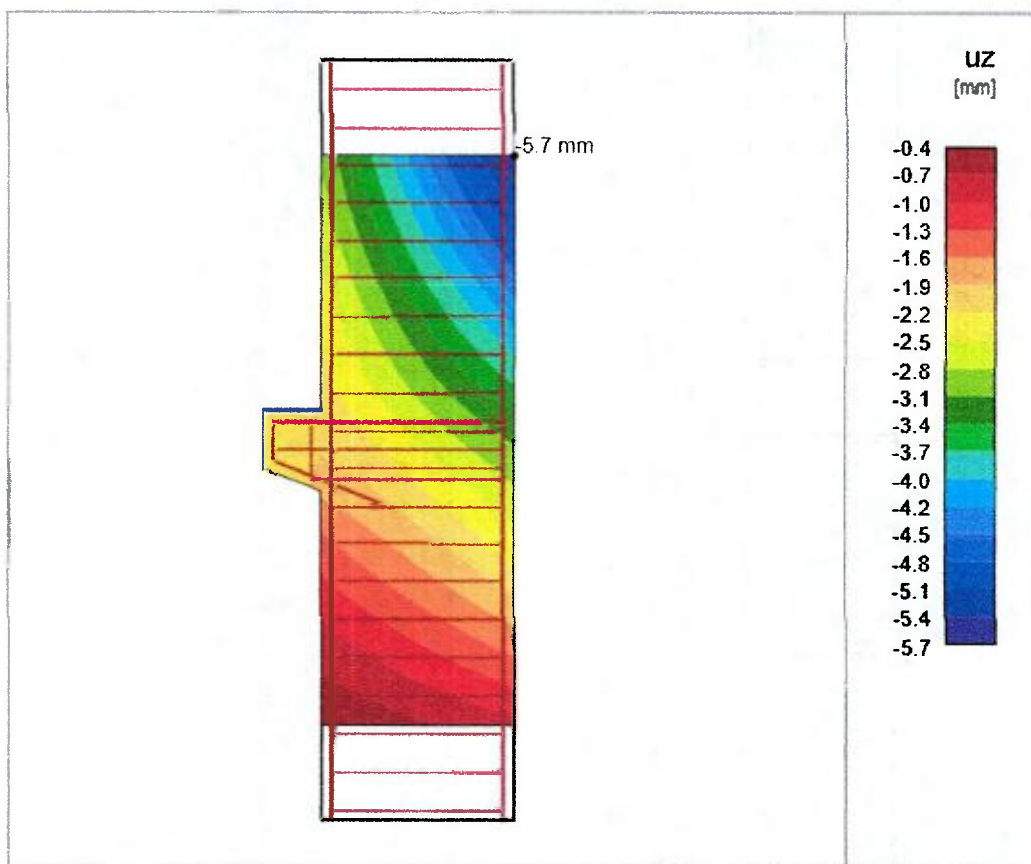


SLS - Deflection

Detailed deflection results: C2, Load increment: P100.0%, V100.0%

Member	X [m]	Z [m]	$u_{z,st}$ [mm]	$u_{z,lt}$ [mm]	Δu_z [mm]	u_z [mm]	
Upper column	0.50	1.50	-1.8	-5.7	0.0	-5.7	OK
Upper column	0.50	0.07	-1.0	-3.2	0.0	-3.2	OK
Lower column	0.50	0.00	-1.0	-3.1	0.0	-3.1	OK
Left beam	-0.65	0.15	-0.7	-2.3	0.0	-2.3	OK
Left beam	-0.80	-0.15	-0.6	-2.1	0.0	-2.1	OK
Lower column	0.50	-1.50	-0.3	-0.9	0.0	-0.9	OK

Deflection



6.2 DISEÑO DE ESTRUCTURA METALICA

La estructura de la edificación debe diseñarse para que tenga resistencia y rigidez adecuadas ante las cargas mínimas de diseño prescritas por el Reglamento y debe, además, verificarse que dispone de rigidez adecuada para limitar la deformabilidad ante las cargas de servicio.

Los coeficientes de reducción de resistencia en utilizados son:

Flexión:	$\phi = 0.90$
Compresión Axial:	$\phi = 0.90$
Cortante y Torsión:	$\phi = 0.90$
Tensión fractura:	$\phi = 0.75$

A continuación, se especificará el procedimiento de diseño de cada uno de los elementos que componen el sistema estructural.

En cada punto a lo largo de la longitud de la viga, se debe satisfacer la siguiente ecuación:

$$M_u \leq \phi_b M_n \quad \phi_b = 0.90$$

Donde M_u , es el momento bajo cargas mayoradas (del análisis estructural) y M_n es la resistencia nominal de flexión de la viga.

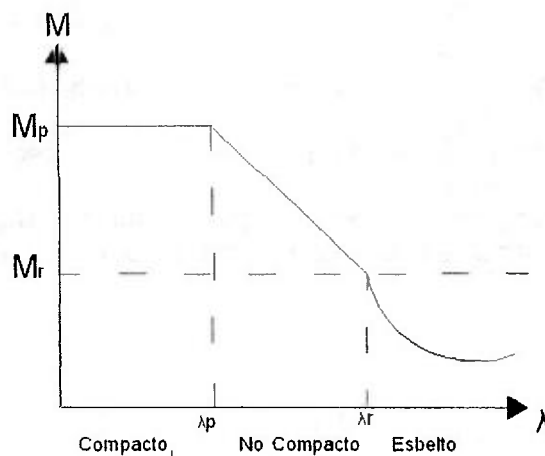
M_u : Resistencia a flexión de vigas, calculada con base en PLP, PLA, PLT o momento plástico de la sección M_p .

$$M_p = ZF_y \leq 1.5 M_y$$

En general, la resistencia M_n basada en PLP y PLA depende de dos variables: Relación ancho-espesor de la aleta o el alma.

$$\lambda = b_f / (2t_f) \text{ para PLP}$$

$$\lambda = h_c / t_w \text{ para PLA}$$



En el AISC se usa el símbolo " λ " para la relación ancho-espesor. Para una sección de ala ancha, los valores para λ se definen como $b_f / (2t_f)$ para PLP y h_c / t_f para PLA. Para determinar M_n con base en PLP y PLA, el valor λ se compara con λ_p y λ_r .

Procedimiento Diseño elástico:

1. Hallar los diagramas de M_u y V_u
2. Seleccionar el perfil más liviano que cumpla $\phi M_p \geq M_u$
3. Verificar la sección compacta PLP y PLA
4. Verificar espaciamiento L_b de soportes laterales PLT, para que $M_n = M_p$
5. Verificar $\phi V_n \geq V_u$
6. Verificar las deflexiones. $\delta_{\max} < \frac{L}{360}$ por carga viva de servicio. L: longitud libre de la viga.

Diseño Acero elementos en Flexo Compresión. Ecuación de Interacción: (F.2.8.1.1 Y F.2.8.1.2)

Hallada ajustando la curva a los resultados de las soluciones exactas. La ecuación para elementos simétricos bajo flexión biaxial.

$$\frac{P_u}{\phi P_n} \geq 0.2 \quad \frac{P_u}{\phi P_n} + \frac{8}{9} \left[\frac{M_{ux}}{\phi_b M_{nx}} + \frac{M_{uy}}{\phi_b M_{ny}} \right] \leq 1.0$$

$$\frac{P_u}{\phi P_n} < 0.2 \quad \frac{P_u}{2\phi P_n} + \left[\frac{M_{ux}}{\phi_b M_{nx}} + \frac{M_{uy}}{\phi_b M_{ny}} \right] \leq 1.0$$

C_b Debería basarse en la forma del momento elástico de segundo orden entre soportes laterales. Existen 2 formas:

Si la forma del diagrama de momento de segundo orden es conocida

$$C_b = \frac{12.5 M_{\max}}{2.5 M_{\max} + 3M_A + 4M_B + 3M_C}$$

$M_{\max} + M_A + M_B + M_C =$ Momento de segundo orden

Si la forma del diagrama de momentos de segundo orden es desconocida, usar $C_b = 1.0$ que es conservativo.

Una vez introducido el modelo computacional con todos los requerimientos antes mencionados, se realizan las iteraciones necesarias hasta que el diseño esté terminado.

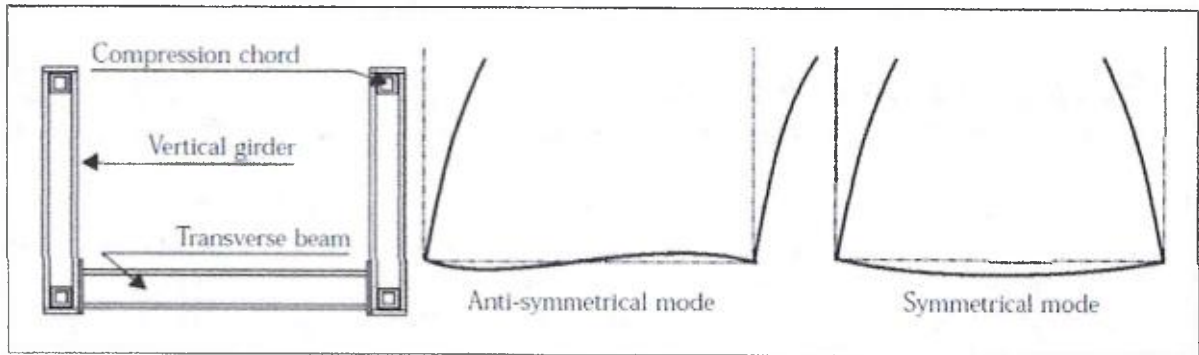


Figura 34 tipología estructural de las rampas

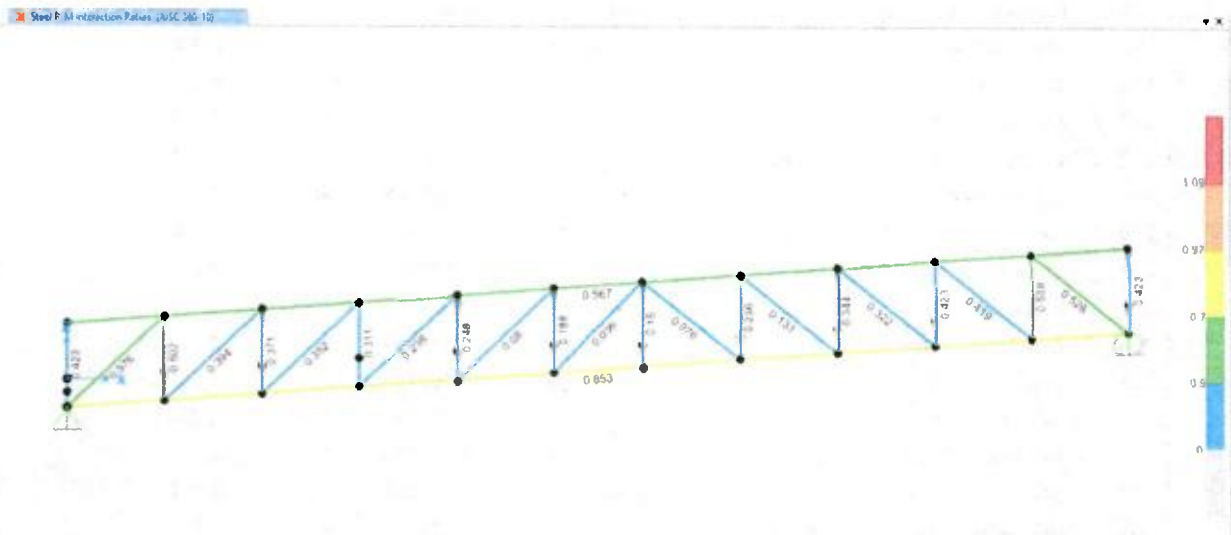


Figura 35 índices de sobre esfuerzo rampa tipo 1

Tabla 4 índices sobre esfuerzo rampa tipo 1

TABLE: Steel Design 1 - Summary Data - AISC 360-10							
Frame	DesignSect	DesignType	Status	Ratio	RatioType	Combo	Location
Text	Text	Text	Text	Unitless	Text	Text	m
39	TB150x100x4mm	Column	No Messages	0.187906	PMM	B.2.4-2	1.3
40	TB150x100x4mm	Column	No Messages	0.149631	PMM	B.2.4-2	1.44583
41	TB150X150X6mm	Column	No Messages	0.423334	PMM	B.2.4-5.6	1.3
42	TB150x100x4mm	Column	No Messages	0.422902	PMM	B.2.4-5.5	1.3
117	tb200x150x6mm	Brace	No Messages	0.853246	PMM	B.2.4-7.8	0
154	TB150x100x4mm	Column	No Messages	0.187906	PMM	B.2.4-2	1.3
155	TB150x100x4mm	Column	No Messages	0.149631	PMM	B.2.4-2	1.44583
156	TB150X150X6mm	Column	No Messages	0.423334	PMM	B.2.4-5.7	1.3
157	TB150x100x4mm	Column	No Messages	0.422902	PMM	B.2.4-5.8	1.3
190	tb60x60x3mm	Beam	No Messages	0.028643	PMM	B.2.4-5.2	1
191	tb150x100x3mm	Beam	No Messages	0.333965	PMM	B.2.4-5.6	2
193	tb60x60x3mm	Beam	No Messages	0.055665	PMM	B.2.4-2	1
194	tb60x60x3mm	Beam	No Messages	0.044426	PMM	B.2.4-2	1
195	tb60x60x3mm	Beam	No Messages	0.062402	PMM	B.2.4-2	1
196	tb60x60x3mm	Beam	No Messages	0.063164	PMM	B.2.4-2	1
197	tb60x60x3mm	Beam	No Messages	0.055538	PMM	B.2.4-2	1
198	tb60x60x3mm	Beam	No Messages	0.058971	PMM	B.2.4-2	1
199	tb60x60x3mm	Beam	No Messages	0.055208	PMM	B.2.4-2	1
200	tb60x60x3mm	Beam	No Messages	0.045861	PMM	B.2.4-2	1
201	tb60x60x3mm	Beam	No Messages	0.030998	PMM	B.2.4-2	1
202	tb60x60x3mm	Beam	No Messages	0.008117	PMM	B.2.4-1	1
203	tb150x100x3mm	Beam	No Messages	0.278853	PMM	B.2.4-5.6	2
204	tb150x100x3mm	Beam	No Messages	0.201178	PMM	B.2.4-2	0
205	tb150x100x3mm	Beam	No Messages	0.223944	PMM	B.2.4-5.7	0
206	tb150x100x3mm	Beam	No Messages	0.203278	PMM	B.2.4-2	0
207	tb150x100x3mm	Beam	No Messages	0.194868	PMM	B.2.4-2	0
208	tb150x100x3mm	Beam	No Messages	0.195886	PMM	B.2.4-2	0
209	tb150x100x3mm	Beam	No Messages	0.205328	PMM	B.2.4-2	0
210	tb150x100x3mm	Beam	No Messages	0.204008	PMM	B.2.4-2	0
211	tb150x100x3mm	Beam	No Messages	0.202292	PMM	B.2.4-2	0
212	tb150x100x3mm	Beam	No Messages	0.258411	PMM	B.2.4-5.6	2
213	tb150x100x3mm	Beam	No Messages	0.29895	PMM	B.2.4-5.6	2
214	TB150x100x4mm	Column	No Messages	0.558427	PMM	B.2.4-2	1.32917
215	TB150x100x4mm	Column	No Messages	0.558427	PMM	B.2.4-2	1.32917
216	TB150x100x4mm	Column	No Messages	0.42296	PMM	B.2.4-2	1.35833
217	TB150x100x4mm	Column	No Messages	0.42296	PMM	B.2.4-2	1.35833
218	TB150x100x4mm	Column	No Messages	0.34412	PMM	B.2.4-2	1.3875
219	TB150x100x4mm	Column	No Messages	0.34412	PMM	B.2.4-2	1.3875

220	TB150x100x4mm	Column	No Messages	0.256415	PMM	B.2.4-2	1.41667
221	TB150x100x4mm	Column	No Messages	0.256415	PMM	B.2.4-2	1.41667
222	TB150x100x4mm	Column	No Messages	0.502232	PMM	B.2.4-2	1.29998
223	TB150x100x4mm	Column	No Messages	0.502232	PMM	B.2.4-2	1.29998
224	TB150x100x4mm	Column	No Messages	0.370805	PMM	B.2.4-2	1.3
225	TB150x100x4mm	Column	No Messages	0.370805	PMM	B.2.4-2	1.3
226	TB150x100x4mm	Column	No Messages	0.310544	PMM	B.2.4-2	1.29995
227	TB150x100x4mm	Column	No Messages	0.310544	PMM	B.2.4-2	1.29995
228	TB150x100x4mm	Column	No Messages	0.247614	PMM	B.2.4-2	1.3
229	TB150x100x4mm	Column	No Messages	0.247614	PMM	B.2.4-2	1.3
263	TB150x100x4mm	Brace	No Messages	0.575701	PMM	B.2.4-2	3.04857
264	TB150x100x4mm	Brace	No Messages	0.393819	PMM	B.2.4-2	3.04858
265	TB150x100x4mm	Brace	No Messages	0.351555	PMM	B.2.4-2	0
266	TB150x100x4mm	Brace	No Messages	0.237663	PMM	B.2.4-2	0
267	TB150x100x4mm	Brace	No Messages	0.079502	PMM	B.2.4-2	1.52429
268	TB150x100x4mm	Brace	No Messages	0.036034	PMM	B.2.4-2	1.44849
269	TB150x100x4mm	Brace	No Messages	0.075999	PMM	B.2.4-2	2.83595
270	TB150x100x4mm	Brace	No Messages	0.13251	PMM	B.2.4-2	2.83595
271	TB150x100x4mm	Brace	No Messages	0.322258	PMM	B.2.4-2	2.83595
272	TB150x100x4mm	Brace	No Messages	0.419334	PMM	B.2.4-2	2.83595
275	TB150x100x4mm	Brace	No Messages	0.575701	PMM	B.2.4-2	3.04857
276	TB150x100x4mm	Brace	No Messages	0.465057	PMM	B.2.4-2	3.04858
277	TB150x100x4mm	Brace	No Messages	0.351555	PMM	B.2.4-2	0
278	TB150x100x4mm	Brace	No Messages	0.237663	PMM	B.2.4-2	0
279	TB150x100x4mm	Brace	No Messages	0.079502	PMM	B.2.4-2	1.52429
280	TB150x100x4mm	Brace	No Messages	0.036034	PMM	B.2.4-2	1.44849
281	TB150x100x4mm	Brace	No Messages	0.075999	PMM	B.2.4-2	2.83595
282	TB150x100x4mm	Brace	No Messages	0.13251	PMM	B.2.4-2	2.83595
283	TB150x100x4mm	Brace	No Messages	0.322258	PMM	B.2.4-2	2.83595
284	TB150x100x4mm	Brace	No Messages	0.419334	PMM	B.2.4-2	2.83595
286	TB150x100x4mm	Brace	No Messages	0.525906	PMM	B.2.4-2	2.83595
287	TB150x100x4mm	Brace	No Messages	0.525906	PMM	B.2.4-2	2.83595
2	tb200x150x6mm	Brace	No Messages	0.853246	PMM	B.2.4-7.5	0
3	tb200x200x6mm	Brace	No Messages	0.566581	PMM	B.2.4-2	11.0292
9	tb200x200x6mm	Brace	No Messages	0.566581	PMM	B.2.4-2	11.0292

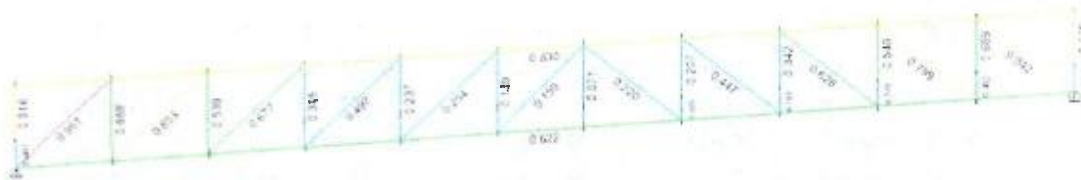


Figura 36 índices de sobre esfuerzo rampa tipo 2

Tabla 5 índices sobre esfuerzo rampa tipo 2

UniqueName	Design Type	Design Section	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio
13	Column	HE160A	0.775	0.377	0.027	0.37	0.026
15	Column	HE160A	0.768	0.374	0.029	0.365	0.027
17	Column	HE160A	0.095	0.016	0.046	0.032	0.014
19	Column	HE160A	0.164	0.03	0.056	0.077	0.017
47	Column	HE160A	0.316	0.089	0.044	0.183	0.013
49	Column	HE160A	0.537	0.241	0.045	0.252	0.024
53	Column	HE160A	0.682	0.304	0.046	0.331	0.044
72	Column	HE160A	0.207	0.057	0.06	0.09	0.018
74	Column	HE160A	0.342	0.089	0.057	0.197	0.017
77	Column	HE160A	0.549	0.24	0.049	0.261	0.025
4	Column	HE160A	0.689	0.304	0.047	0.338	0.045
23	Column	HE160A	0.117	0.015	0.035	0.068	0.015
23	Column	HE160A	0.14	0.03	0.042	0.068	
24	Column	HE160A	0.071	0.002	0.009	0.06	0.023
90	Column	HE160A	0.345	0.09	0.047	0.208	0.031
91	Column	HE160A	0.237	0.06	0.044	0.132	0.024
38	Column	HE160A	0.35	0.091	0.046	0.213	0.032
40	Column	HE160A	0.242	0.06	0.041	0.14	0.026
44	Column	HE280A	0.142	0.023	0.02	0.099	0.01
21	Column	HE160A	0.916	0.527	0.029	0.36	0.019
14	Column	HE160A	0.498	0.332	0.001	0.165	0.12
16	Column	HE160A	0.494	0.331	0.0004682	0.163	0.119
18	Column	HE160A	0.08	0.002	0.005	0.072	0.027
20	Column	HE160A	0.082	0.005	0.013	0.065	0.016
20	Column	HE160A	0.036	0	0.013	0.023	
25	Column	HE160A	0.936	0.538	0.036	0.362	0.086

86	Column	HE160A	0.668	0.302	0.037	0.329	0.119
89	Column	HE160A	0.539	0.241	0.042	0.257	0.047
34	Column	HE160A	0.672	0.303	0.038	0.332	0.119
36	Column	HE160A	0.544	0.241	0.042	0.261	0.047
45	Column	HE160A	0.167	0.045	0.046	0.075	0.032
48	Column	HE160A	0.264	0.07	0.088	0.107	0.018
52	Column	HE160A	0.441	0.095	0.205	0.142	0.058
70	Column	HE160A	0.093	0.021	0.028	0.044	0.025
73	Column	HE160A	0.183	0.045	0.054	0.084	0.028
75	Column	HE160A	0.278	0.069	0.092	0.116	0.019
1	Column	HE160A	0.026	0.008	0.001	0.017	0.006
3	Column	HE160A	0.452	0.095	0.209	0.148	0.06
22	Column	HE160A	0.481	0.297	0.015	0.169	0.085
71	Beam	IPE330	0.922	0.914	0.006	0.031	0.01
76	Beam	IPE330	0.922	0.914	0.002	0.03	0.01
46	Beam	IPE330	0.028	0.004	0.008	0.016	0.032
46	Beam	IPE330	0.626	0.543	0.001	0.082	
51	Beam	IPE330	0.027	0.003	0.008	0.016	0.032
51	Beam	IPE330	0.622	0.543	0.001	0.078	
88	Beam	IPE160	0.594	0.014	0.537	0.043	0.031
88	Beam	IPE160	0.565	0.001	0.521	0.043	
92	Beam	IPE160	0.356	0.055	0.286	0.015	0.018
92	Beam	IPE160	0.29	0	0.275	0.015	
93	Beam	IPE160	0.242	0.074	0.161	0.008	0.011
93	Beam	IPE160	0.148	0	0.141	0.008	
94	Beam	IPE160	0.327	0.301	0.025	0.0003699	0.007
94	Beam	IPE160	0.089	0.001	0.085	0.003	
95	Beam	IPE160	0.305	0.265	0.04	0.0004472	0.006
98	Beam	IPE160	0.361	0.322	0.038	0.0002541	0.007
99	Beam	IPE160	0.446	0.415	0.031	0.001	0.009
100	Beam	IPE160	0.498	0.288	0.205	0.005	0.015
101	Beam	IPE160	0.626	0.257	0.359	0.009	0.024
102	Beam	IPE160	0.833	0.099	0.715	0.02	0.041
107	Brace	HE160A	0.679	0.454	0.017	0.207	0.016
108	Brace	HE160A	0.498	0.305	0.016	0.178	0.012
110	Brace	HE160A	0.253	0.078	0.012	0.163	0.007
111	Brace	HE160A	0.162	0.017	0.014	0.131	0.01
112	Brace	HE160A	0.189	0.059	0.004	0.126	0.004
113	Brace	HE160A	0.423	0.257	0.007	0.159	0.01
114	Brace	HE160A	0.619	0.398	0.009	0.213	0.012
115	Brace	HE160A	0.794	0.536	0.012	0.246	0.014
116	Brace	HE160A	0.939	0.675	0.011	0.253	0.029
119	Brace	HE160A	0.677	0.452	0.02	0.204	0.016

120	Brace	HE160A	0.497	0.303	0.02	0.174	0.012
121	Brace	HE160A	0.254	0.076	0.02	0.158	0.007
122	Brace	HE160A	0.159	0.017	0.018	0.124	0.006
123	Brace	HE160A	0.22	0.059	0.019	0.141	0.008
124	Brace	HE160A	0.447	0.257	0.016	0.175	0.011
125	Brace	HE160A	0.628	0.396	0.013	0.219	0.011
126	Brace	HE160A	0.799	0.535	0.014	0.251	0.014
2	Brace	HE160A	0.942	0.674	0.01	0.257	0.029
105	Brace	HE160A	0.952	0.695	0.017	0.24	0.017
106	Brace	HE160A	0.854	0.603	0.018	0.234	0.025
117	Brace	HE160A	0.951	0.694	0.018	0.239	0.017
118	Brace	HE160A	0.853	0.601	0.02	0.232	0.025

Tabla 6 diseño viga compuesta rampa tipo 2

Story: N+0.00

Location: X= 25.18 m Y= -15.52 m

A992Fy50

Beam B13

IPE270

Length: 5.4 m Trib. Area: 11.99 m²

9 0.019 m Ø studs

No camber

Composite Deck Properties

	Deck	Cover (m)	w _c (kN/m ³)	f' _c (MPa)	Ribs	b _{eff} (m)	E _c (S) (MPa)	E _c (D) (MPa)	E _c (V) (MPa)
At Left, at Right	Metaldeck2cal18	0.06	24	21	1	0.675	21556	21556	29100

Loading (DCmpS2 combo)

	Constr.	Dead	SDL	Live NR	Factored
Line Load (kN/m) 0 m→5.4 m	0.000	6.082	0.000	11.100	25.058

End Reactions

	Constr.	Dead	SDL	Live NR	Combo	Factored
I end, J end (kN)	0.0000	16.4209	0.0000	29.9700	DCmpS2	67.6571

Strength Checks

	Combo	Factored	Design	Ratio	Pass
Shear at Ends (kN)	DCmpS2	67.6571	368.5938	0.184	✓
Construction Bending (kN-m)	DCmpC1	31.0355	150.1678	0.207	✓
Positive Bending (kN-m)	DCmpS2	91.3370	150.1678	0.608	✓

Constructability and Serviceability Checks

	Actual	Allowable	Ratio	Pass
Constr. Dead Defl. (m)	0.00572	No Limit	N/A	N/A
Post-concrete Defl. (m)	0.01044	0.0225	0.464	✓
Live Load Defl. (m)	0.01044	0.015	0.696	✓
Total Defl. (m)	0.01616	0.0225	0.718	✓

	Actual	Allowable	Ratio	Pass
Walking Acceleration a_p/g ($\beta = 0.01$ $P_0 = 289$)	0.001882	0.015	0.125	✓

Section Properties					
	PNA (m)	Area (m ²)	S_{bot} (m ³)	I (m ⁴)	ΦM_n (kN-m)
Steel fully braced	0.135	0.0046	0.000429	0.000058	150.1678
Vibrations Check ($E_c = 29100$)	0.03856	0.0235	N/A	0.000235	N/A

Vibration Frequency Values									
Element	L (m)	b_{eff} (m)	Loading	I_{eff} (m ⁴)	D (m ⁴ /m)	B (m)	W (kN)	Δ (m)	f_n (Hz)
Slab	5.4	2.16	2.74+0.192kN/m ²	0.000022	0.000022/2.16	22.18			
Beam	5.4	2.16	6.507kN/m	0.000235	0.000235/2.22	2*3.0021	1*95.0332	0.0015	14.53
Panel							95.0332	0.0015	14.53

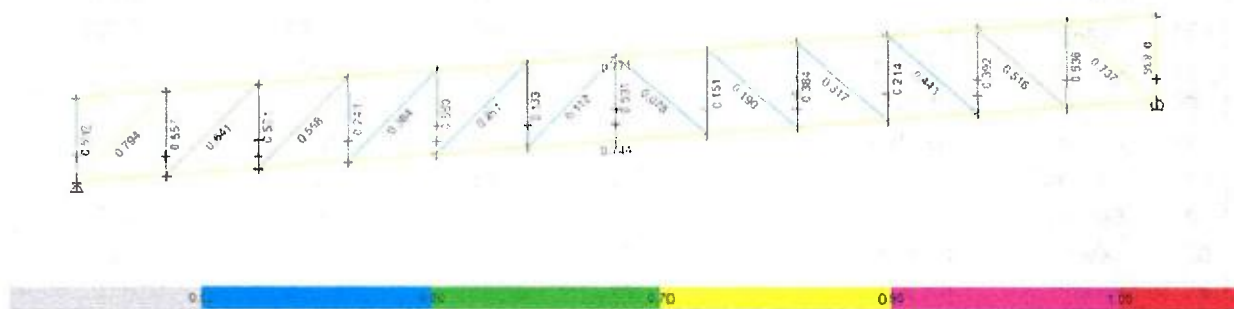


Figura 37 índices de sobre esfuerzo rampa tipo 3

Tabla 7 índices sobre esfuerzo rampa tipo 3

TABLE: Steel Frame Design Summary - AISC 360-10							
Label	Design Type	Design Section	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio
C55	Column	HE140A	0.241	0.076	0.063	0.103	0.085
C56	Column	HE140A	0.133	0.03	0.058	0.045	0.036
C57	Column	HE140A	0.151	0.037	0.056	0.058	0.033
C58	Column	HE140A	0.214	0.063	0.086	0.065	0.041
C59	Column	HE140A	0.536	0.087	0.314	0.136	0.087
C60	Column	HE140A	0.836	0.555	0.17	0.111	0.211

C60	Column	HE140A	0.026	0	0.009	0.016	
C62	Column	HE140A	0.55	0.028	0.048	0.473	0.083
C63	Column	HE140A	0.524	0.002	0.006	0.516	0.065
C63	Column	HE140A	0.531	0.009	0.006	0.516	
C64	Column	HE140A	0.384	0.037	0.031	0.316	0.081
C65	Column	HE140A	0.392	0.08	0.165	0.146	0.159
C68	Column	HE140A	0.241	0.076	0.063	0.103	0.085
C69	Column	HE140A	0.133	0.03	0.058	0.045	0.036
C70	Column	HE140A	0.151	0.037	0.056	0.058	0.033
C71	Column	HE140A	0.214	0.063	0.086	0.065	0.041
C72	Column	HE140A	0.536	0.087	0.314	0.136	0.087
C73	Column	HE140A	0.931	0.652	0.169	0.11	0.211
C73	Column	HE140A	0.026	0	0.01	0.017	
C75	Column	HE140A	0.55	0.028	0.048	0.473	0.082
C76	Column	HE140A	0.524	0.002	0.006	0.516	0.065
C76	Column	HE140A	0.531	0.009	0.006	0.516	
C77	Column	HE140A	0.384	0.037	0.031	0.316	0.081
C78	Column	HE140A	0.392	0.08	0.165	0.146	0.159
C53	Column	HE140A	0.512	0.239	0.073	0.199	0.098
C54	Column	HE140A	0.557	0.075	0.402	0.08	0.25
C61	Column	HE140A	0.571	0.065	0.142	0.364	0.172
C66	Column	HE140A	0.512	0.239	0.073	0.199	0.098
C67	Column	HE140A	0.557	0.075	0.402	0.08	0.25
C74	Column	HE140A	0.571	0.065	0.142	0.364	0.172
B2	Beam	IPE300	0.771	0.705	0.005	0.061	0.021
B2	Beam	IPE300	0.109	0.001	0.085	0.023	
B4	Beam	IPE300	0.771	0.705	0.005	0.061	0.021
B4	Beam	IPE300	0.109	0.001	0.085	0.023	
B96	Beam	IPE140	0.084	0.076	0.008	0	0.002
B96	Beam	IPE140	0.018	0.0001124	0.008	0.01	
B97	Beam	IPE300	0.216	0.006	0.202	0.008	0.044
B97	Beam	IPE300	0.744	0.089	0.582	0.073	
B103	Beam	IPE140	0.142	0.038	0.103	0.001	0.011
B103	Beam	IPE140	0.103	0.0001484	0.102	0.001	
B104	Beam	IPE140	0.069	0.037	0.013	0.019	0.003
B104	Beam	IPE140	0.031	0.0001599	0.011	0.019	
B105	Beam	IPE140	0.786	0.035	0.668	0.082	0.065
B105	Beam	IPE140	0.748	0.0001484	0.666	0.082	
B106	Beam	IPE300	0.216	0.006	0.202	0.008	0.044
B106	Beam	IPE300	0.744	0.089	0.582	0.073	
B107	Beam	IPE140	0.1	0.015	0.077	0.008	0.009
B107	Beam	IPE140	0.083	0.0001791	0.075	0.008	
B95	Beam	IPE140	0.992	0.045	0.926	0.067	0.09

416

B95	Beam	IPE140	0.992	0.0001713	0.924	0.067	
B102	Beam	IPE140	0.355	0.054	0.276	0.024	0.028
B102	Beam	IPE140	0.299	0.0001065	0.275	0.024	
D51	Brace	HE140A	0.558	0.389	0.144	0.025	0.124
D52	Brace	HE140A	0.364	0.257	0.085	0.022	0.074
D53	Brace	HE140A	0.251	0.08	0.145	0.026	0.115
D54	Brace	HE140A	0.737	0.445	0.017	0.274	0.071
D55	Brace	HE140A	0.516	0.45	0.043	0.024	0.058
D56	Brace	HE140A	0.443	0.355	0.069	0.019	0.079
D57	Brace	HE140A	0.317	0.258	0.036	0.023	0.04
D58	Brace	HE140A	0.19	0.083	0.083	0.025	0.056
D59	Brace	HE140A	0.078	0.033	0.018	0.027	0.019
D60	Brace	HE140A	0.112	0.015	0.06	0.037	0.039
D60	Brace	HE140A	0.042	0.001	0.018	0.023	
D63	Brace	HE140A	0.558	0.389	0.144	0.025	0.124
D64	Brace	HE140A	0.364	0.257	0.085	0.022	0.074
D65	Brace	HE140A	0.251	0.08	0.145	0.026	0.115
D66	Brace	HE140A	0.737	0.446	0.017	0.274	0.071
D67	Brace	HE140A	0.516	0.45	0.043	0.024	0.059
D68	Brace	HE140A	0.443	0.355	0.069	0.019	0.079
D69	Brace	HE140A	0.317	0.258	0.036	0.023	0.04
D70	Brace	HE140A	0.19	0.083	0.083	0.025	0.056
D71	Brace	HE140A	0.078	0.033	0.018	0.027	0.019
D72	Brace	HE140A	0.112	0.015	0.06	0.037	0.039
D72	Brace	HE140A	0.042	0.001	0.018	0.023	
D49	Brace	HE140A	0.794	0.634	0.137	0.023	0.087
D50	Brace	HE140A	0.641	0.513	0.108	0.02	0.115
D61	Brace	HE140A	0.794	0.634	0.137	0.023	0.087
D62	Brace	HE140A	0.641	0.513	0.108	0.02	0.115

Tabla 8 diseño viga compuesta rampa tipo 3

Story: N+1.75a

Beam B26

Length: 370.002 cm Trib. Area: 37000 cm²

Location: X= 799.996 cm Y= 185 cm
A992Fy50

60 cm Ø studs
No camber

IPE200

Composite Deck Properties

	Deck	Cover (cm)	w _c (N/cm ²)	f _c (MPa)	Ribs	b _{eff} (cm)	E _c (S) (MPa)	E _c (D) (MPa)	E _c (V) (MPa)
At Left	None	N/A	N/A	0	N/A	0	N/A	N/A	N/A
At Right	Metaldeck3cal20	5	0.024	21	⊥	46.25	21556	21556	29100

Loading (DCmpS2 combo)

	Constr.	Dead	SDL	Live NR	Factored
Line Load (N/cm) 0 cm→370.002 cm	0.00	28.13	0.00	50.00→49.99	113.75→113.74

End Reactions

	Constr.	Dead	SDL	Live NR	Combo	Factored
I end (N)	0.00	5203.79	0.00	9250.02	DCmpS2	21044.59
J end (N)	0.00	5203.77	0.00	9249.98	DCmpS2	21044.48

Strength Checks

	Combo	Factored	Design	Ratio	Pass
Shear at Ends (N)	DCmpS2	21044.59	231663.87	0.091	✓
Construction Bending (N-cm)	DCmpC1	673896.04	6856836.72	0.098	✓
Positive Bending (N-cm)	DCmpS2	1946639.11	6856836.72	0.284	✓

Constructability and Serviceability Checks

	Actual	Allowable	Ratio	Pass
Constr. Dead Defl. (cm)	0.174	No Limit	N/A	N/A
Post-concrete Defl. (cm)	0.31	1.542	0.201	✓
Live Load Defl. (cm)	0.31	1.028	0.302	✓
Total Defl. (cm)	0.485	1.542	0.314	✓
Walking Acceleration a_p /g ($\beta = 0.01$ $P_o = 289$)	0.000044	0.015	0.003	✓

Section Properties

	PNA (cm)	Area (cm²)	S_{bot} (cm³)	I (cm⁴)	ΦM_n (N-cm)
Steel fully braced	10	28.5	194.3	1943	6856836.72
Vibrations Check ($E_c = 33509,29100$)	3.157	82.3	N/A	9599.5	N/A

Vibration Frequency Values

Element	L (cm)	b_{eff} (cm)	Loading	I_{eff} (cm⁴)	D (cm⁴/cm)	B (cm)	W (N)	Δ (cm)	f_n (Hz)
Slab	370.002	74	0.281+0.019N/cm ²	1081.8	1081.8/74	1994.961			
Beam	370.002	74	30.04N/cm	9599.5	9599.5/100	1*231.137	1*25693.78	0.038	29.023
Panel							25693.78	0.038	29.023

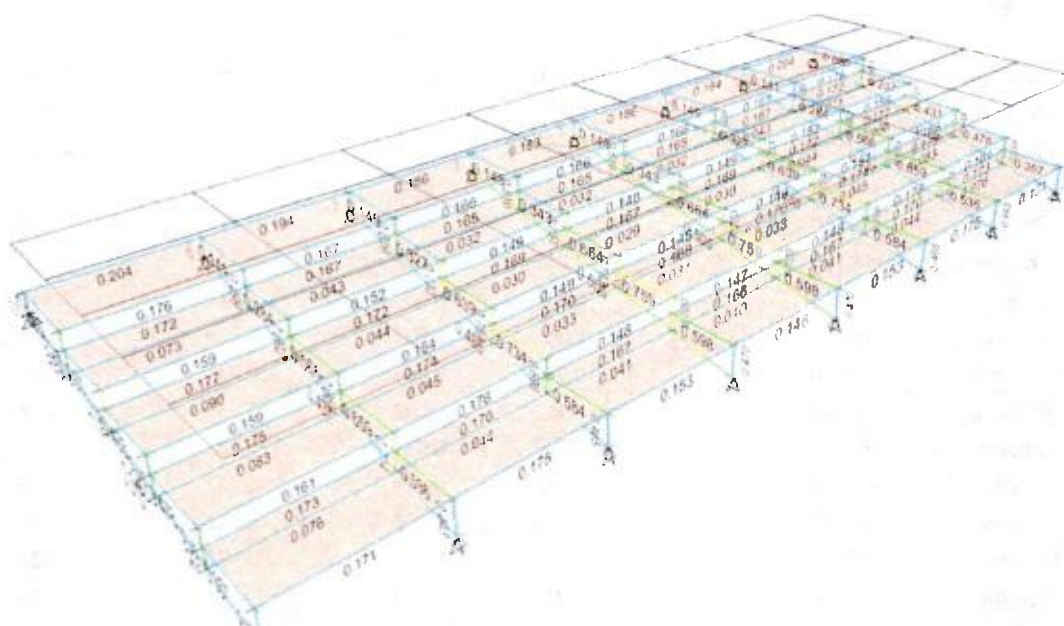


Figura 38 índices de sobre esfuerzo rampa tipo 4

Tabla 9 índices sobre esfuerzo rampa tipo 4

Label	Design Type	Design Section	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio	V Major Ratio
C9	Column	IPE220	0.563	0.006	0.3	0.257	0.268
C10	Column	IPE220	0.701	0.013	0.461	0.227	0.513
C11	Column	IPE220	0.648	0.018	0.473	0.158	0.585
C12	Column	IPE220	0.504	0.015	0.371	0.117	0.459
C13	Column	IPE220	0.26	0.017	0.243	0.001	0.176
C14	Column	IPE220	0.425	0.019	0.405	0.0002318	0.386
C15	Column	IPE220	0.499	0.012	0.403	0.085	0.338
C16	Column	IPE220	0.692	0.021	0.6	0.071	0.664
C17	Column	IPE220	0.659	0.028	0.624	0.007	0.782
C18	Column	IPE220	0.714	0.029	0.616	0.07	0.65
C19	Column	IPE220	0.443	0.032	0.41	0.0001277	0.294
C20	Column	IPE220	0.45	0.018	0.432	0	0.409
C21	Column	IPE220	0.509	0.008	0.351	0.15	0.395
C22	Column	IPE220	0.733	0.022	0.689	0.022	0.763
C23	Column	IPE220	0.754	0.03	0.71	0.013	0.886

C24	Column	IPE220	0.696	0.03	0.653	0.013	0.726
C25	Column	IPE220	0.465	0.032	0.433	0	0.311
C26	Column	IPE220	0.455	0.018	0.436	0	0.413
C27	Column	IPE220	0.516	0.008	0.37	0.137	0.421
C28	Column	IPE220	0.757	0.022	0.729	0.006	0.807
C29	Column	IPE220	0.783	0.031	0.749	0.003	0.932
C30	Column	IPE220	0.7	0.03	0.661	0.009	0.755
C31	Column	IPE220	0.47	0.033	0.437	0	0.314
C32	Column	IPE220	0.455	0.018	0.436	0	0.413
C33	Column	IPE220	0.516	0.008	0.37	0.137	0.421
C34	Column	IPE220	0.757	0.022	0.729	0.006	0.807
C35	Column	IPE220	0.783	0.031	0.749	0.003	0.932
C36	Column	IPE220	0.7	0.03	0.661	0.009	0.755
C37	Column	IPE220	0.47	0.033	0.437	0	0.314
C38	Column	IPE220	0.45	0.018	0.432	0	0.409
C39	Column	IPE220	0.509	0.008	0.351	0.15	0.395
C40	Column	IPE220	0.733	0.022	0.689	0.022	0.763
C41	Column	IPE220	0.754	0.03	0.71	0.013	0.886
C42	Column	IPE220	0.696	0.03	0.653	0.013	0.726
C43	Column	IPE220	0.465	0.032	0.433	0	0.311
C44	Column	IPE220	0.425	0.019	0.405	0.0002318	0.386
C45	Column	IPE220	0.499	0.012	0.403	0.085	0.338
C46	Column	IPE220	0.692	0.021	0.6	0.071	0.664
C47	Column	IPE220	0.659	0.028	0.624	0.007	0.782
C48	Column	IPE220	0.714	0.029	0.616	0.07	0.65
C49	Column	IPE220	0.443	0.032	0.41	0.0001277	0.294
C50	Column	IPE220	0.31	0.008	0.061	0.241	0.213
C50	Column	IPE220	0.171	0	0.015	0.156	
C51	Column	IPE220	0.563	0.006	0.3	0.257	0.268
C52	Column	IPE220	0.701	0.013	0.461	0.227	0.513
C53	Column	IPE220	0.648	0.018	0.473	0.158	0.585
C54	Column	IPE220	0.504	0.015	0.371	0.117	0.459
C55	Column	IPE220	0.26	0.017	0.243	0.001	0.176
C56	Column	IPE220	0.31	0.008	0.061	0.241	0.213
C56	Column	IPE220	0.171	0	0.015	0.156	
B85	Beam	IPE360	0.091	0.001	0.056	0.034	0.096
B85	Beam	IPE360	0.31	0.026	0.281	0.003	
B86	Beam	IPE180	0.08	0.015	0.065	0.001	0.016
B87	Beam	IPE180	0.237	0.032	0.205	0.0004696	0.061
B89	Beam	IPE360	0.246	0.0001294	0.23	0.016	0.148
B89	Beam	IPE360	0.437	0.034	0.4	0.003	
B90	Beam	IPE180	0.141	0.01	0.131	0.0002761	0.035
B91	Beam	IPE180	0.284	0.018	0.266	0.0002806	0.078

418

B92	Beam	IPE360	0.1	0.003	0.083	0.013	0.161
B92	Beam	IPE360	0.488	0.042	0.445	0.002	
B93	Beam	IPE180	0.149	0.013	0.136	0	0.035
B94	Beam	IPE180	0.327	0.025	0.301	0.0002285	0.089
B95	Beam	IPE360	0.101	0.002	0.086	0.013	0.165
B95	Beam	IPE360	0.505	0.045	0.46	0.001	
B96	Beam	IPE180	0.148	0.013	0.135	0	0.034
B97	Beam	IPE180	0.343	0.026	0.317	0	0.094
B98	Beam	IPE360	0.101	0.002	0.086	0.013	0.165
B98	Beam	IPE360	0.505	0.045	0.46	0.001	
B99	Beam	IPE180	0.148	0.013	0.135	0	0.034
B100	Beam	IPE180	0.343	0.026	0.317	0	0.094
B101	Beam	IPE360	0.1	0.003	0.083	0.013	0.161
B101	Beam	IPE360	0.488	0.042	0.445	0.002	
B102	Beam	IPE180	0.149	0.013	0.136	0	0.035
B103	Beam	IPE180	0.327	0.025	0.301	0.0002285	0.089
B104	Beam	IPE360	0.246	0.0001294	0.23	0.016	0.148
B104	Beam	IPE360	0.437	0.034	0.4	0.003	
B105	Beam	IPE180	0.141	0.01	0.131	0.0002761	0.035
B106	Beam	IPE180	0.284	0.018	0.266	0.0002806	0.078
B107	Beam	IPE360	0.091	0.001	0.056	0.034	0.096
B107	Beam	IPE360	0.31	0.026	0.281	0.003	
B108	Beam	IPE180	0.08	0.015	0.065	0.001	0.016
B109	Beam	IPE180	0.237	0.032	0.205	0.0004696	0.061
B125	Beam	IPE180	0.433	0.039	0.395	0.0002898	0.114
B126	Beam	IPE180	0.478	0.032	0.446	0.001	0.126
B127	Beam	IPE180	0.357	0.014	0.342	0.001	0.098
B128	Beam	IPE180	0.566	0.02	0.546	0	0.158
B129	Beam	IPE180	0.659	0.016	0.642	0.0004193	0.183
B130	Beam	IPE180	0.536	0.007	0.529	0.0004241	0.154
B131	Beam	IPE180	0.639	0.029	0.61	0.0002583	0.176
B132	Beam	IPE180	0.734	0.024	0.711	0.0001765	0.202
B133	Beam	IPE180	0.584	0.01	0.574	0.0001517	0.166
B134	Beam	IPE180	0.664	0.03	0.634	0	0.183
B135	Beam	IPE180	0.759	0.024	0.735	0	0.209
B136	Beam	IPE180	0.598	0.01	0.588	0.0001064	0.17
B137	Beam	IPE180	0.664	0.03	0.634	0	0.183
B138	Beam	IPE180	0.759	0.024	0.735	0	0.209
B139	Beam	IPE180	0.598	0.01	0.588	0.0001064	0.17
B140	Beam	IPE180	0.639	0.029	0.61	0.0002583	0.176
B141	Beam	IPE180	0.734	0.024	0.711	0.0001765	0.202
B142	Beam	IPE180	0.584	0.01	0.574	0.0001517	0.166
B143	Beam	IPE180	0.566	0.02	0.546	0	0.158

B144	Beam	IPE180	0.659	0.016	0.642	0.0004193	0.183
B145	Beam	IPE180	0.536	0.007	0.529	0.0004241	0.154
B146	Beam	IPE180	0.433	0.039	0.395	0.0002898	0.114
B147	Beam	IPE180	0.478	0.032	0.446	0.001	0.126
B148	Beam	IPE180	0.357	0.014	0.342	0.001	0.098
B8	Beam	IPE180	0.204	0.003	0.201	0.0003593	0.083
B8	Beam	IPE180	0.12	0.001	0.119	0.0001576	
B9	Beam	IPE180	0.194	0.03	0.163	0.001	0.073
B9	Beam	IPE180	0.099	0.0002182	0.099	0.0002289	
B10	Beam	IPE180	0.186	0.023	0.162	0.001	0.073
B11	Beam	IPE180	0.183	0.017	0.165	0.0003142	0.072
B12	Beam	IPE180	0.186	0.023	0.162	0.001	0.073
B13	Beam	IPE180	0.194	0.03	0.163	0.001	0.073
B13	Beam	IPE180	0.099	0.0002182	0.099	0.0002289	
B14	Beam	IPE180	0.204	0.003	0.201	0.0003593	0.083
B14	Beam	IPE180	0.12	0.001	0.119	0.0001576	
B15	Beam	IPE180	0.176	0	0.176	0	0.073
B15	Beam	IPE180	0.043	0.001	0.042	0	
B16	Beam	IPE180	0.167	0	0.167	0	0.074
B16	Beam	IPE180	0.114	0	0.114	0.0002266	
B17	Beam	IPE180	0.166	0	0.166	0	0.072
B17	Beam	IPE180	0.051	0.0002002	0.05	0.0001716	
B18	Beam	IPE180	0.166	0	0.166	0	0.072
B19	Beam	IPE180	0.166	0	0.166	0	0.072
B19	Beam	IPE180	0.051	0.0002002	0.05	0.0001716	
B20	Beam	IPE180	0.167	0	0.167	0	0.074
B20	Beam	IPE180	0.114	0	0.114	0.0002266	
B21	Beam	IPE180	0.176	0	0.176	0	0.073
B21	Beam	IPE180	0.043	0.001	0.042	0	
B29	Beam	IPE180	0.172	0.008	0.163	0.001	0.073
B30	Beam	IPE180	0.167	0.005	0.162	0.0003544	0.068
B31	Beam	IPE180	0.165	0.003	0.162	0.0001692	0.067
B32	Beam	IPE180	0.165	0.003	0.162	0.0001682	0.067
B33	Beam	IPE180	0.165	0.003	0.162	0.0001692	0.067
B34	Beam	IPE180	0.167	0.005	0.162	0.0003544	0.068
B35	Beam	IPE180	0.172	0.008	0.163	0.001	0.073
B36	Beam	IPE180	0.159	0	0.159	0	0.066
B37	Beam	IPE180	0.152	0	0.152	0	0.065
B38	Beam	IPE180	0.149	0	0.149	0	0.064
B39	Beam	IPE180	0.148	0	0.148	0	0.064
B40	Beam	IPE180	0.149	0	0.149	0	0.064
B41	Beam	IPE180	0.152	0	0.152	0	0.065
B42	Beam	IPE180	0.159	0	0.159	0	0.066

B43	Beam	IPE180	0.177	0.011	0.167	0.0001805	0.076
B44	Beam	IPE180	0.172	0.011	0.161	0.001	0.068
B45	Beam	IPE180	0.169	0.008	0.16	0.001	0.067
B46	Beam	IPE180	0.167	0.007	0.16	0.0004052	0.066
B47	Beam	IPE180	0.169	0.008	0.16	0.001	0.067
B48	Beam	IPE180	0.172	0.011	0.161	0.001	0.068
B49	Beam	IPE180	0.177	0.011	0.167	0.0001805	0.076
B57	Beam	IPE180	0.159	0	0.159	0	0.065
B58	Beam	IPE180	0.154	0.039	0.114	0.001	0.065
B59	Beam	IPE180	0.149	0	0.149	0	0.065
B60	Beam	IPE180	0.148	0	0.148	0	0.064
B61	Beam	IPE180	0.149	0	0.149	0	0.065
B62	Beam	IPE180	0.154	0.039	0.114	0.001	0.065
B63	Beam	IPE180	0.159	0	0.159	0	0.065
B64	Beam	IPE180	0.175	0.011	0.163	0.001	0.073
B65	Beam	IPE180	0.174	0.012	0.16	0.001	0.067
B66	Beam	IPE180	0.17	0.009	0.16	0.001	0.067
B67	Beam	IPE180	0.168	0.007	0.16	0.001	0.066
B68	Beam	IPE180	0.17	0.009	0.16	0.001	0.067
B69	Beam	IPE180	0.174	0.012	0.16	0.001	0.067
B70	Beam	IPE180	0.175	0.011	0.163	0.001	0.073
B78	Beam	IPE180	0.161	0.037	0.123	0.001	0.071
B79	Beam	IPE180	0.176	0.049	0.126	0.001	0.066
B80	Beam	IPE180	0.148	0	0.148	0	0.065
B81	Beam	IPE180	0.147	0	0.147	0	0.064
B82	Beam	IPE180	0.148	0	0.148	0	0.065
B83	Beam	IPE180	0.176	0.049	0.126	0.001	0.066
B84	Beam	IPE180	0.161	0.037	0.123	0.001	0.071
B149	Beam	IPE180	0.173	0.008	0.165	0.001	0.067
B150	Beam	IPE180	0.17	0.009	0.16	0.001	0.068
B151	Beam	IPE180	0.167	0.006	0.161	0.001	0.068
B152	Beam	IPE180	0.166	0.004	0.161	0.0004313	0.066
B153	Beam	IPE180	0.167	0.006	0.161	0.001	0.068
B154	Beam	IPE180	0.17	0.009	0.16	0.001	0.068
B155	Beam	IPE180	0.173	0.008	0.165	0.001	0.067
B163	Beam	IPE180	0.171	0.028	0.143	0.001	0.075
B164	Beam	IPE180	0.175	0.049	0.125	0.001	0.065
B165	Beam	IPE180	0.153	0.038	0.115	0.0004358	0.065
B166	Beam	IPE180	0.146	0	0.146	0	0.064
B167	Beam	IPE180	0.153	0.038	0.115	0.0004358	0.065
B168	Beam	IPE180	0.175	0.049	0.125	0.001	0.065
B169	Beam	IPE180	0.171	0.028	0.143	0.001	0.075
B1	Beam	IPE180	0.073	0.006	0.038	0.029	0.009

B2	Beam	IPE180	0.043	0.009	0.011	0.023	0.003
B3	Beam	IPE180	0.032	0.009	0.002	0.021	0.002
B4	Beam	IPE180	0.032	0.009	0.003	0.019	0.002
B5	Beam	IPE180	0.032	0.009	0.002	0.021	0.002
B6	Beam	IPE180	0.043	0.009	0.011	0.023	0.003
B7	Beam	IPE180	0.073	0.006	0.038	0.029	0.009
B22	Beam	IPE180	0.09	0.013	0.068	0.01	0.013
B23	Beam	IPE180	0.044	0.02	0.023	0.001	0.003
B24	Beam	IPE180	0.03	0.02	0.01	0.0003152	0.003
B25	Beam	IPE180	0.029	0.02	0.009	0.0001993	0.002
B26	Beam	IPE180	0.03	0.02	0.01	0.0003152	0.003
B27	Beam	IPE180	0.044	0.02	0.023	0.001	0.003
B28	Beam	IPE180	0.09	0.013	0.068	0.01	0.013
B50	Beam	IPE180	0.083	0.014	0.065	0.004	0.013
B51	Beam	IPE180	0.045	0.022	0.022	0.002	0.003
B52	Beam	IPE180	0.033	0.022	0.01	0.001	0.003
B53	Beam	IPE180	0.031	0.022	0.009	0.001	0.002
B54	Beam	IPE180	0.033	0.022	0.01	0.001	0.003
B55	Beam	IPE180	0.045	0.022	0.022	0.002	0.003
B56	Beam	IPE180	0.083	0.014	0.065	0.004	0.013
B71	Beam	IPE180	0.076	0.008	0.042	0.026	0.008
B72	Beam	IPE180	0.044	0.012	0.008	0.025	0.004
B73	Beam	IPE180	0.041	0.011	0.006	0.024	0.003
B74	Beam	IPE180	0.04	0.011	0.007	0.022	0.003
B75	Beam	IPE180	0.041	0.011	0.006	0.024	0.003
B76	Beam	IPE180	0.044	0.012	0.008	0.025	0.004
B77	Beam	IPE180	0.076	0.008	0.042	0.026	0.008

dddd

6.3 DISEÑO CONEXIONES DE ESTRUCTURA METALICA

Diseño anclaje en ménsula

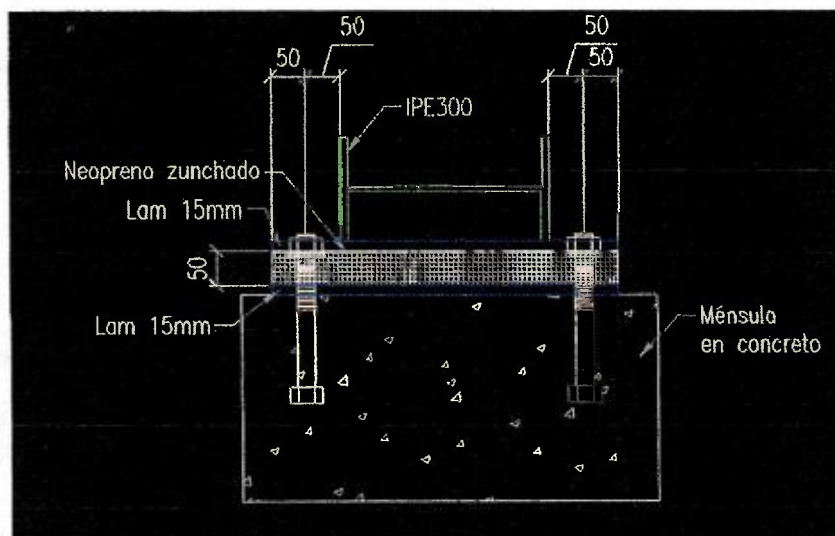


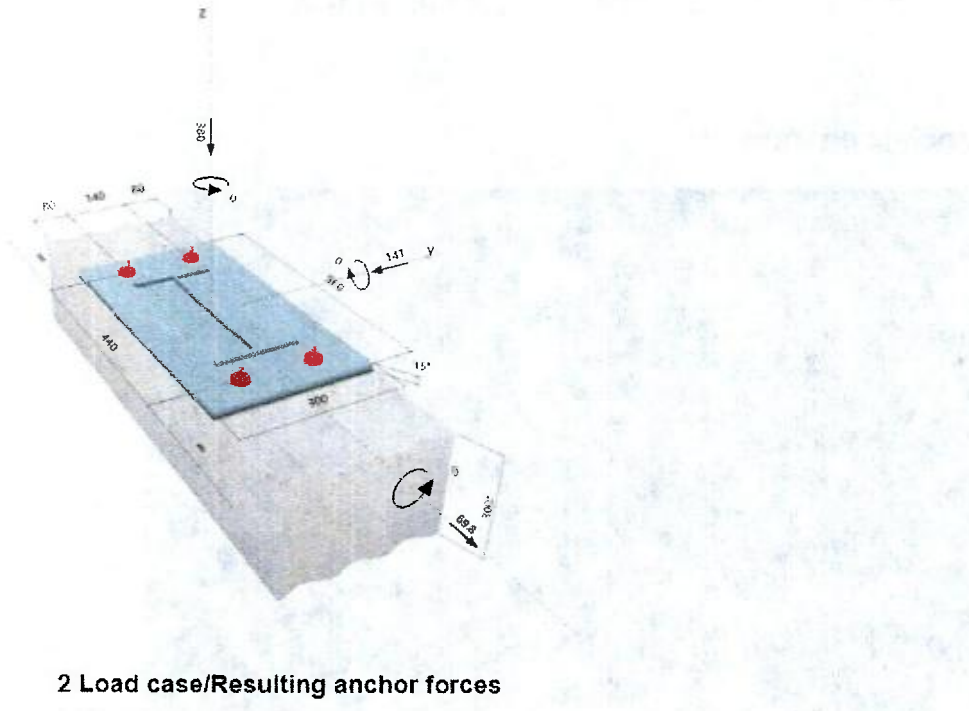
Figura 39 Detalle anclaje en ménsula

1 Input data

Anchor type and diameter:	ASTM 193 B7 Φ 1 1/4
Effective embedment depth:	$h_{ef} = 170$ mm
Material:	ASTM 193
Proof:	Design method ACI 318-14 / CIP
Stand-off installation:	$e_b = 0$ mm (no stand-off); $t = 15$ mm
Anchor plate:	$l \times b \times t = 550$ mm x 300 mm x 15 mm; (Recommended plate thickness: not calculated)
Profile:	IPE: (L x W x T x FT) = 330 mm x 160 mm x 8 mm x 12 mm
Base material:	uncracked concrete, 4000, $f_c' = 4.061$ psi; $h = 300$ mm
Reinforcement:	tension: condition A, shear: condition A; anchor reinforcement: tension, shear edge reinforcement: none or < No. 4 bar Corner reinforcement acc. to ACI 318-14 Section 17.5.2.3 (c) present

^R - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [mm] & Loading [kN, kNm]



2 Load case/Resulting anchor forces

Load case: Design loads

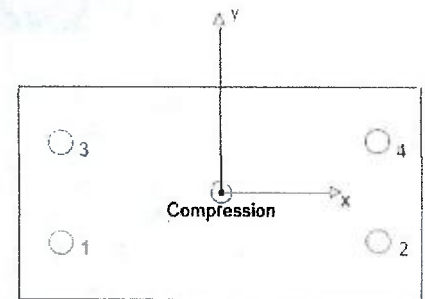
Anchor reactions [kN]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	0.000	39.333	17.450	-35.250
2	0.000	39.333	17.450	-35.250
3	0.000	39.333	17.450	-35.250
4	0.000	39.333	17.450	-35.250

max. concrete compressive strain: 0.08 [‰]
 max. concrete compressive stress: 2.26 [N/mm²]
 resulting tension force in (x/y)=(0/0): 0.000 [kN]
 resulting compression force in (x/y)=(0/0): 380.000 [kN]

Anchor forces are calculated based on the assumption of a rigid anchor plate.



4 Shear load

	Load V_{ua} [kN]	Capacity ϕV_n [kN]	Utilization $p_v = V_{ua}/\phi V_n$	Status
Steel Strength*	39.333	97.500	41	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	157.331	179.377	88	OK
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

* anchor having the highest loading ** anchor group (relevant anchors)

Shear Anchor Reinforcement has been selected

4.1 Steel Strength

$$V_{sa} = 0.6 A_{sa,v} f_{sa} \quad \text{ACI 318-14 Eq. (17.5.1.2b)}$$

$$\phi V_{steel} \geq V_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

Variables

$A_{sa,v}$ [mm ²]	f_{sa} [N/mm ²]
625	399.90

Calculations

V_{sa} [kN]
149.999

Results

V_{sa} [kN]	ϕ_{steel}	ϕV_{sa} [kN]	V_{ua} [kN]
149.999	0.650	97.500	39.333

4.2 Pryout Strength

$$V_{epg} = k_{cp} \left[\left(\frac{A_{Nc}}{A_{Nco}} \right) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_c \right] \quad \text{ACI 318-14 Eq. (17.5.3.1b)}$$

$$\phi V_{epg} \geq V_{ua} \quad \text{ACI 318-14 Table 17.3.1.1}$$

$$A_{Nc} \text{ see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)}$$

$$A_{Nco} = 9 h_{ef}^2 \quad \text{ACI 318-14 Eq. (17.4.2.1c)}$$

$$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e_N}{3 h_{ef}}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.4)}$$

$$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.5b)}$$

$$\psi_{cp,N} = \text{MAX} \left(\frac{c_{a,min}}{c_{ao}}, \frac{1.5 h_{ef}}{c_{ao}} \right) \leq 1.0 \quad \text{ACI 318-14 Eq. (17.4.2.7b)}$$

$$N_b = k_{cs} \lambda_s \sqrt{f_c} h_{ef}^{1.5} \quad \text{ACI 318-14 Eq. (17.4.2.2a)}$$

Variables

k_{cc}	h_{ef} [mm]	$e_{c1,N}$ [mm]	$e_{c2,N}$ [mm]	$c_{a,min}$ [mm]
2	170	0	0	80

$\psi_{c,N}$	c_{ao} [mm]	k_{cs}	λ_s	f_c [psi]
1.250	-	24	1.000	4,061

Calculations

A_{Nc} [mm ²]	A_{Nco} [mm ²]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [kN]
285,000	260,100	1.000	1.000	0.794	1.000	117.799

Results

V_{epg} [kN]	$\phi_{concrete}$	ϕV_{epg} [kN]	V_{ua} [kN]
256.253	0.700	179.377	157.331

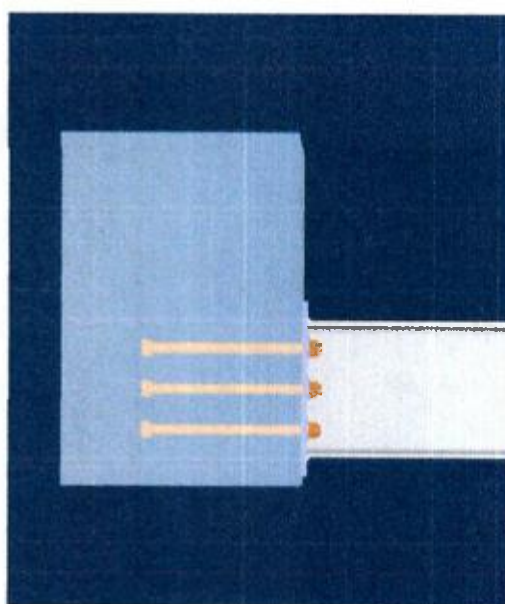


Figura 40 Detalle anclaje rampa 4

Steel connections

Results

Connection name : Pinned BP
Connection ID : 1

Family: Column - Base (CB)
Type: Base plate
Design code: AISC 360-16 LRFD, ACI 318-08

DEMANDS

Description	Pu [Ton]	Mu22 [Ton*m]	Mu33 [Ton*m]	Vu2 [Ton]	Vu3 [Ton]	Load type
DL	7.00	0.00	0.00	2.00	15.00	Design

Design for major axis Base plate (AISC 360-16 LRFD)

GEOMETRIC CONSIDERATIONS

Dimensions References	Unit	Value	Min. value	Max. value	Sta.
<u>Base plate</u>					
Distance from anchor to edge	[cm]	3.73	0.64	—	✓
Weld size	[1/16in]	5	3	—	✓ table J2.4

DESIGN CHECK

422

Verification References	Unit	Capacity	Demand	Ctrl EQ	Ratio	
<u>Pedestal</u>						
Axial bearing	[Ton/cm2]	0.17	0.00	DL	0.00	DG1 3.1.1;
<u>Base plate</u>						
Flexural yielding (bearing interface)	[Ton*m/m]	1.78	0.00	DL	0.00	DG1 Eq.
3.3.13						
Flexural yielding (tension interface)	[Ton*m/m]	1.78	0.58	DL	0.33	DG1 Eq.
3.3.13						
<u>Column</u>						
Weld capacity	[Ton/m]	186.45	8.17	DL	0.04	p. 8-9, Sec. J2.5, Sec. J2.4, DG1 p. 35
Elastic method weld shear capacity	[Ton/m]	124.30	3.35	DL	0.03	p. 8-9, Sec. J2.5, Sec. J2.4
Elastic method weld axial capacity	[Ton/m]	186.45	20.59	DL	0.11	p. 8-9, Sec. J2.5, Sec. J2.4
Ratio					0.33	

Major axis Anchors

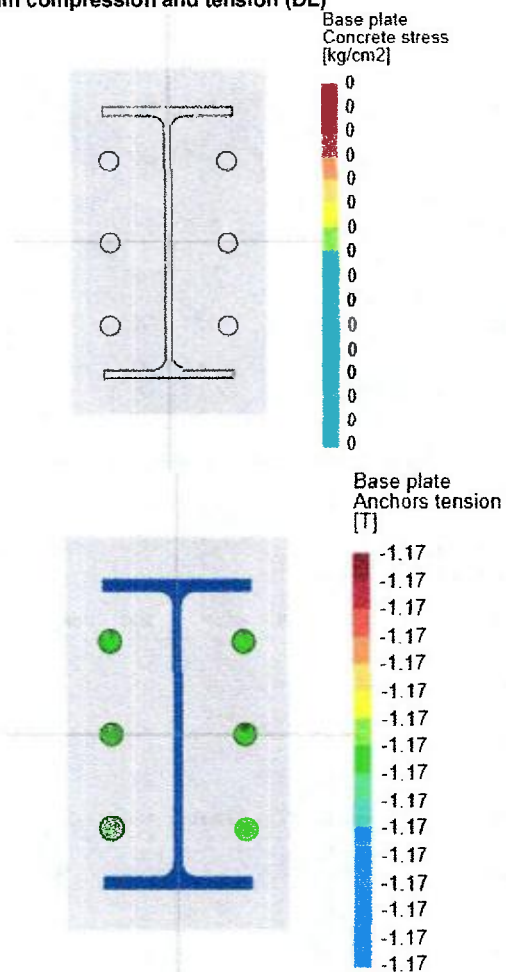
GEOMETRIC CONSIDERATIONS

Dimensions	Unit	Value	Min. value	Max. value	Sta.	References
<u>Anchors</u>						
Anchor spacing	[cm]	10.86	10.16	--	✓	Sec. D.8.1
Concrete cover	[cm]	13.27	5.08	--	✓	Sec. 7.7.1
Effective length	[cm]	41.65	--	58.35	✓	

DESIGN CHECK

Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	References
Anchor tension	[Ton]	11.95	1.17	DL	0.10	Eq. D-3
Breakout of anchor in tension	[Ton]	15.66	1.17	DL	0.07	Eq. D-4, Sec. D.4.1.1
Breakout of group of anchors in tension	[Ton]	20.13	7.00	DL	0.35	Eq. D-5, Sec. D.4.1.1
Pullout of anchor in tension	[Ton]	21.36	1.17	DL	0.05	Sec. D.4.1.1
Side-face blowout of anchor in tension	[Ton]	22.03	1.17	DL	0.05	Sec.
D.5.4.1,						
Side-face blowout of group of anchors in tension	[Ton]	26.52	2.33	DL	0.09	Sec. D.4.1.1 Eq. D-17, Sec. D.4.1.1
Anchor shear	[Ton]	6.22	0.33	DL	0.05	Eq. D-20
Breakout of anchor in shear	[Ton]	14.16	0.33	DL	0.02	Sec. D.4.1.1
Breakout of group of anchors in shear	[Ton]	14.16	2.00	DL	0.14	Sec. D.4.1.1
Pryout of anchor in shear	[Ton]	31.33	0.33	DL	0.01	Eq. D-4, Sec. D.4.1.1
Pryout of group of anchors in shear	[Ton]	40.25	2.00	DL	0.05	Eq. D-5, Sec. D.4.1.1
Interaction of tensile and shear forces	[Ton]	1.20	0.00	DL	0.00	Eq. D-3, Eq. D-4, Sec.
D.4.1.1,						
						Eq. D-5, Sec.
D.5.4.1,						
						Eq. D-17, Eq. D-20, Sec. D.7
Ratio					0.35	
Global critical strength ratio					0.35	

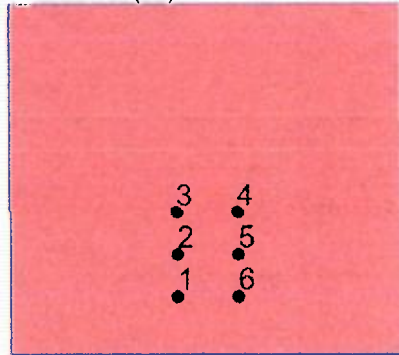
Major axis
Maximum compression and tension (DL)



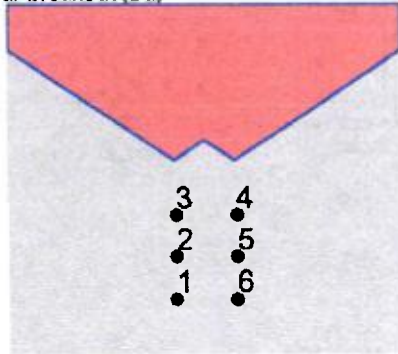
Maximum bearing pressure	0.00	[Kg/cm2]
Minimum bearing pressure	0.00	[Kg/cm2]
Maximum anchor tension	1.17	[Ton]
Minimum anchor tension	1.17	[Ton]
Neutral axis angle	0.00	
Bearing length	-1E32	[cm]

Anchors tensions

Anchor	Transverse [cm]	Longitudinal [cm]	Shear [Ton]	Tension [Ton]
1	-7.70	-10.86	0.33	1.17
2	-7.70	0.00	0.33	1.17
3	-7.70	10.86	0.33	1.17
4	7.70	10.86	0.33	1.17
5	7.70	0.00	0.33	1.17
6	7.70	-10.86	0.33	1.17

Major axis**Results for tensile breakout (DL)**

Group	Area [cm ²]	Tension [Ton]	Anchors
1	9000.00	7.00	1, 2, 3, 4, 5, 6

Results for shear breakout (DL)

Group	Area [cm ²]	Shear [Ton]	Anchors
1	6000.00	2.00	1, 2, 3, 4, 5, 6
2	6000.00	1.33	2, 3, 4, 5
3	6000.00	0.67	3, 4

Diseño conexiones

Steel connections

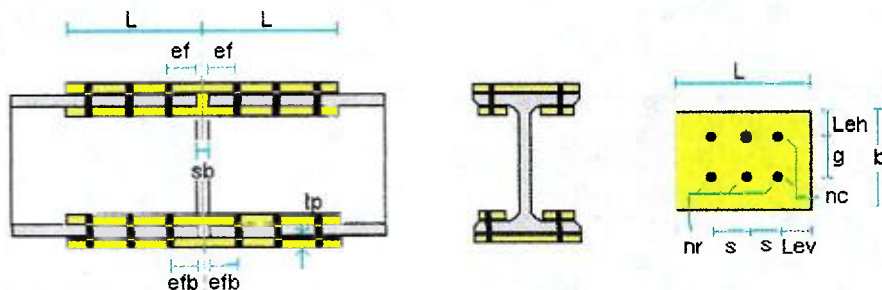
Data

Connection name : FP_BS_1/2PL_1B3/4
Connection ID : 3M

Family: Beam splice (BS)
Type: Flange-plated

GENERAL INFORMATION

Connector



MEMBERS

Beam

Beam section : IPE 330
Beam material : A572 Gr50
sb: Beam setback : 1.27 cm

FLANGE PLATE

Connector

L: Top plate length : 38.64 cm
b: Top plate width : 16.3 cm
tp: Top plate thickness : 1.5 cm
Lb: Bottom plate length : 38.64 cm
bb: Bottom plate width : 16.3 cm
tpb: Bottom plate thickness : 1.5 cm
Plate material : A572 Gr50

Beams - plates connection

Consider interior plate : Yes
Connection type : Bolted
Bolts : 5/8" A325 N
nc: Bolt columns : 2
nr: Rows of Bolts : 6
g: Gage - transverse center-to-center spacing : 8.3 cm
s: Pitch - longitudinal center-to-center spacing : 6 cm
Lev: Longitudinal distance to top plate edge : 4 cm
Leh: Transverse distance to top plate edge : 4 cm
ef: Longitudinal distance to beam edge : 4 cm
Levb: Longitudinal distance to bottom plate edge : 4 cm
Lehb: Transverse distance to bottom plate edge : 4 cm
efb: Longitudinal distance to beam edge : 4 cm
Hole type on beam : Standard (STD)
Hole type on top plate : Standard (STD)
Hole type on bottom plate : Standard (STD)

424

Steel connections

Results

Connection name : FP_BS_1/2PL_1B3/4
Connection ID : 3M

Family: Beam splice (BS)
Type: Flange-plated
Design code: AISC 360-16 LRFD

DEMANDS

Description	Ru [Ton]	Pu [Ton]	Mu [Ton*m]	PuTop [Ton]	PuBot [Ton]	Load type
DL	0.00	-146.00	18.00	-129.51	-16.49	Design

GEOMETRIC CONSIDERATIONS

Dimensions References	Unit	Value	Min. value	Max. value	Sta.
<u>Plate (beam side)</u>					
Vertical center-to-center spacing (pitch)	[cm]	6.00	4.23	27.60	✓ Sec. J3.3, Sec. J3.5
Horizontal center-to-center spacing (gage)	[cm]	8.30	4.23	27.60	✓ Sec. J3.3, Sec. J3.5
<u>Top flange plate data</u>					
Vertical edge distance J3.4,	[cm]	4.00	2.22	--	✓ Tables J3.5
Horizontal edge distance J3.4,	[cm]	4.00	2.22	--	✓ Tables J3.5
<u>Bottom flange plate data</u>					
Vertical edge distance J3.4,	[cm]	4.00	2.22	--	✓ Tables J3.5
Horizontal edge distance J3.4,	[cm]	4.00	2.22	--	✓ Tables J3.5
<u>Beam</u>					
Vertical edge distance J3.4,	[cm]	4.00	2.22	--	✓ Tables J3.5
Horizontal edge distance J3.4,	[cm]	3.85	2.22	--	✓ Tables J3.5

DESIGN CHECK

Verification References	Unit	Capacity	Demand	Ctrl EQ	Ratio
<u>Top plate (beam side)</u>					
Compression	[Ton]	134.07	125.17	DL	0.93 Sec. J4.4
Tension yielding	[Ton]	134.07	0.00	DL	0.00 Eq. J4-1
Bolts shear	[Ton]	135.35	127.55	DL	0.94 Tables (7-1..14)
Bolt bearing (Top plate)	[Ton]	468.92	127.55	DL	0.27 Eq. J3-6
Block shear	[Ton]	332.09	0.00	DL	0.00 Eq. J4-5
Tension rupture	[Ton]	106.06	0.00	DL	0.00 Eq. J4-2

<u>Bottom plate (beam side)</u>						
Tension yielding	[Ton]	134.07	0.00	DL	0.00	Eq. J4-1
Compression	[Ton]	134.07	20.83	DL	0.16	Sec. J4.4
Bolts shear	[Ton]	135.35	18.45	DL	0.14	Tables (7-
1..14)						
Tension rupture	[Ton]	106.06	0.00	DL	0.00	Eq. J4-2
Block shear	[Ton]	332.09	0.00	DL	0.00	Eq. J4-5
Bolt bearing (Bottom plate)	[Ton]	468.92	18.45	DL	0.04	Eq. J3-6
<u>Beam</u>						
Top flange bending	[Ton*m]	22.34	18.00	DL	0.81	Eq. F13-1
Top flange bolt bearing under shear load	[Ton]	179.75	129.51	DL	0.72	Eq. J3-6
Top flange block shear	[Ton]	134.10	129.51	DL	0.97	Eq. J4-5
Bottom flange bending	[Ton*m]	22.34	18.00	DL	0.81	Eq. F13-1
Bottom flange bolt bearing under shear load	[Ton]	179.75	129.51	DL	0.72	Eq. J3-6
Bottom flange block shear	[Ton]	134.10	129.51	DL	0.97	Eq. J4-5
Global critical strength ratio		0.97				

Steel connections

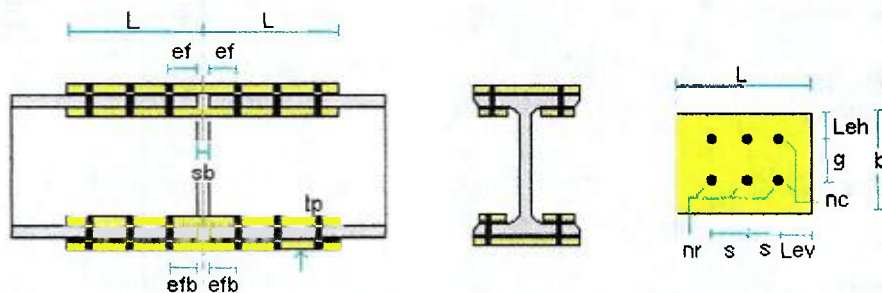
Data

Connection name : FP_BS_1/2PL_1B3/4
Connection ID : 4M

Family: Beam splice (BS)
Type: Flange-plated

GENERAL INFORMATION

Connector



MEMBERS

Beam

Beam section : IPE 300
Beam material : A572 Gr50
sb: Beam setback : 1 cm

FLANGE PLATE

Connector

L: Top plate length : 32.95 cm
b: Top plate width : 15.62 cm
tp: Top plate thickness : 1.27 cm
Lb: Bottom plate length : 32.95 cm
bb: Bottom plate width : 15.62 cm
tpb: Bottom plate thickness : 1.27 cm
Plate material : A572 Gr50

Beams - plates connection

Consider interior plate	:	Yes
Connection type	:	Bolted
Bolts	:	5/8" A325 N
nc: Bolt columns	:	2
nr: Rows of Bolts	:	5
g: Gage - transverse center-to-center spacing	:	7.62 cm
s: Pitch - longitudinal center-to-center spacing	:	6 cm
Lev: Longitudinal distance to top plate edge	:	4.45 cm
Leh: Transverse distance to top plate edge	:	4 cm
ef: Longitudinal distance to beam edge	:	4 cm
Levb: Longitudinal distance to bottom plate edge	:	4.45 cm
Lehb: Transverse distance to bottom plate edge	:	4 cm
efb: Longitudinal distance to beam edge	:	4 cm
Hole type on beam	:	Standard (STD)
Hole type on top plate	:	Standard (STD)
Hole type on bottom plate	:	Standard (STD)

Steel connections

Results

Connection name : FP_BS_1/2PL_1B3/4
Connection ID : 4M

Family: Beam splice (BS)
Type: Flange-plated
Design code: AISC 360-16 LRFD

DEMANDS

Description	Ru [Ton]	Pu [Ton]	Mu [Ton*m]	PufTop [Ton]	PufBot [Ton]	Load type
DL	0.00	-89.00	15.00	-96.35	7.35	Design

GEOMETRIC CONSIDERATIONS

Dimensions References	Unit	Value	Min. value	Max. value	Sta.
<u>Plate (beam side)</u>					
Vertical center-to-center spacing (pitch)	[cm]	6.00	4.23	25.68	✓ Sec. J3.3, Sec. J3.5
Horizontal center-to-center spacing (gage)	[cm]	7.62	4.23	25.68	✓ Sec. J3.3, Sec. J3.5
<u>Top flange plate data</u>					
Vertical edge distance J3.4,	[cm]	4.44	2.22	--	✓ Tables J3.5
Horizontal edge distance J3.4,	[cm]	4.00	2.22	--	✓ Tables J3.5
<u>Bottom flange plate data</u>					
Vertical edge distance J3.4,	[cm]	4.44	2.22	--	✓ Tables J3.5
Horizontal edge distance J3.4,	[cm]	4.00	2.22	--	✓ Tables

						J3.5
<u>Beam</u>						
J3.4, Vertical edge distance	[cm]	4.00	2.22	—	✓	Tables
						J3.5
J3.4, Horizontal edge distance	[cm]	3.69	2.22	—	✓	Tables
						J3.5
DESIGN CHECK						
Verification	Unit	Capacity	Demand	Ctrl EQ	Ratio	
References						
<u>Top plate (beam side)</u>						
Compression	[Ton]	110.62	92.47	DL	0.84	Sec. J4.4
Tension yielding	[Ton]	110.62	0.00	DL	0.00	Eq. J4-1
1..14) Bolts shear	[Ton]	112.79	94.50	DL	0.84	Tables (7-
Bolt bearing (Top plate)	[Ton]	331.69	94.50	DL	0.28	Eq. J3-6
Block shear	[Ton]	241.21	0.00	DL	0.00	Eq. J4-5
Tension rupture	[Ton]	86.67	0.00	DL	0.00	Eq. J4-2
<u>Bottom plate (beam side)</u>						
Tension yielding	[Ton]	110.62	3.47	DL	0.03	Eq. J4-1
Compression	[Ton]	110.62	0.00	DL	0.00	Sec. J4.4
1..14) Bolts shear	[Ton]	112.79	5.50	DL	0.05	Tables (7-
Tension rupture	[Ton]	86.67	3.47	DL	0.04	Eq. J4-2
Block shear	[Ton]	241.21	3.47	DL	0.01	Eq. J4-5
Bolt bearing (Bottom plate)	[Ton]	331.69	5.50	DL	0.02	Eq. J3-6
<u>Beam</u>						
Top flange bending	[Ton*m]	17.09	15.00	DL	0.88	Eq. F13-1
Top flange bolt bearing under shear load	[Ton]	139.30	96.35	DL	0.69	Eq. J3-6
Top flange block shear	[Ton]	105.58	96.35	DL	0.91	Eq. J4-5
Bottom flange bending	[Ton*m]	17.09	15.00	DL	0.88	Eq. F13-1
Bottom flange bolt bearing under shear load	[Ton]	139.30	96.35	DL	0.69	Eq. J3-6
Bottom flange block shear	[Ton]	105.58	96.35	DL	0.91	Eq. J4-5
Global critical strength ratio	0.91					

Steel connections

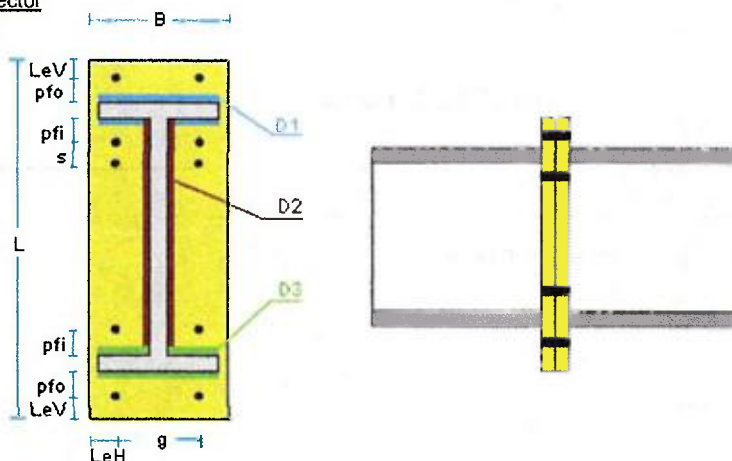
Data

Connection name : MEP BS Flush
Connection ID : 5

Family: Beam splice (BS)
Type: Moment end plate

GENERAL INFORMATION

Connector



MEMBERS

Configuration

Is apex

: No

Include beam stiffener

: No

Right beam

Beams

Beam type

: Prismatic member

Beam section

: IPE 360

Beam material

: A572 Gr50

Left beam

Beams

Beam type

: Prismatic member

Beam section

: IPE 360

Beam material

: A572 Gr50

END PLATE

Connector

Plate extension

: Extended both ways

Width

: 18 cm

tp: Plate thickness

: 1.9 cm

Plate material

: A572 Gr50

Fy

: 3.52 T/cm²

Fu

: 4.57 T/cm²

Hole type on plate

: Standard (STD)

Beam side

Top flange weld type

: Full penetration

D1: Weld size to top beam flange (1/16in)

: 7

Bottom flange weld type

: Full penetration

D3: Weld size to bottom beam flange (1/16in)

: 6

Welding electrode to beam web

: E70XX

D2: Weld size to beam web (1/16in)

: 5

End plate

Bolts	:	7/8" A325 N
g: Gage - transverse center-to-center spacing	:	8 cm
Lev: Vertical edge distance	:	3 cm
Leh: Horizontal edge distance	:	5 cm
<u>Bolt group (top extension)</u>		
pfo t: Distance from bolt rows to flange	:	4 cm
<u>Bolt group (top flange)</u>		
Bolts rows number	:	1
pfi t: Distance from bolt rows to flange	:	4 cm
<u>Bolt group (bottom flange)</u>		
Bolts rows number	:	2
pfi b: Distance from bolt rows to flange	:	4 cm
pfi b: Vertical spacing between inner bolt rows	:	7 cm
<u>Bolt group (bottom extension)</u>		
s b: Distance from bolt rows to flange	:	4 cm

Steel connections

Results

Connection name : MEP BS Flush
Connection ID : 5

Family: Beam splice (BS)
Type: Moment end plate
Design code: AISC 360-16 LRFD

DEMANDS

Description	Ru [Ton]	Pu [Ton]	Mu [Ton*m]	PufTop [Ton]	PufBot [Ton]	Load type
DL	16.00	-28.00	25.00	0.00	0.00	Design

GEOMETRIC CONSIDERATIONS

Dimensions References	Unit	Value	Min. value	Max. value	Sta.
<u>Right side beam</u>					
<u>Extended end plate</u>					
Vertical edge distance	[cm]	3.00	2.86	15.24	✓ Sec. J3.5
Horizontal edge distance	[cm]	5.00	2.86	15.24	✓ Sec. J3.5
Vertical bolt spacing (external flange)	[cm]	9.27	5.93	--	✓ Sec. J3.3
Vertical bolt spacing (internal flange)	[cm]	7.00	5.93	--	✓ Sec. J3.3
Horizontal center-to-center spacing (gage)	[cm]	8.00	5.93	17.00	✓ Sec. J3.3, DG4 Sec.
2.4,					
2.1,					DG4 Sec.
					2.4, DG16
Sec. 2.5					
Outer bolt distance (external flange)	[cm]	4.00	3.49	--	✓ DG4 Sec.
2.1					
Inner bolt distance (external flange)	[cm]	4.00	3.49	--	✓ DG4 Sec.
2.1					
Outer bolt distance (internal flange)	[cm]	4.00	3.49	--	✓ DG4 Sec.
2.1					
118					

2.1	Inner bolt distance (internal flange)	[cm]	4.00	3.49	--	✓	DG4 Sec.
1.1	Bolt diameter	[cm]	2.22	--	3.81	✓	DG4 Sec.
	<u>Beam</u>						
	Web	[1/16in]	5	3	--	✓	table J2.4
	<u>Left side beam</u>						
	<u>Extended end plate</u>						
	Vertical edge distance	[cm]	3.00	2.86	15.24	✓	Sec. J3.5
	Horizontal edge distance	[cm]	5.00	2.86	15.24	✓	Sec. J3.5
	Vertical bolt spacing (external flange)	[cm]	9.27	5.93	--	✓	Sec. J3.3
	Vertical bolt spacing (internal flange)	[cm]	7.00	5.93	--	✓	Sec. J3.3
	Horizontal center-to-center spacing (gage)	[cm]	8.00	5.93	17.00	✓	Sec. J3.3, DG4 Sec.
2.4,							DG4 Sec.
2.1,							2.4, DG16
Sec. 2.5							
2.1	Outer bolt distance (external flange)	[cm]	4.00	3.49	--	✓	DG4 Sec.
2.1	Inner bolt distance (external flange)	[cm]	4.00	3.49	--	✓	DG4 Sec.
2.1	Outer bolt distance (internal flange)	[cm]	4.00	3.49	--	✓	DG4 Sec.
2.1	Inner bolt distance (internal flange)	[cm]	4.00	3.49	--	✓	DG4 Sec.
1.1	Bolt diameter	[cm]	2.22	--	3.81	✓	DG4 Sec.
	<u>Beam</u>						
	Web	[1/16in]	5	3	--	✓	table J2.4

DESIGN CHECK

Verification References	Unit	Capacity	Demand	Ctrl EQ	Ratio	
<u>Right side beam</u>						
<u>Moment end plate (external flange)</u>						
2.5	Flexural yielding	[Ton*m]	31.70	0.00 DL	0.00	DG16 Sec
2.5	No prying bolt moment strength	[Ton*m]	25.56	0.00 DL	0.00	DG16 Sec
2.5	Bolt rupture with prying moment strength	[Ton*m]	20.42	0.00 DL	0.00	DG16 Sec
1..14)	Bolts shear	[Ton]	44.16	16.00 DL	0.36	Tables (7-
	Bolt bearing under shear load	[Ton]	97.75	0.00 DL	0.00	Eq. J3-6
3.12	Shear yielding	[Ton]	64.92	42.99 DL	0.66	DG4 Eq.
3.14,	Shear rupture	[Ton]	50.48	42.99 DL	0.85	DG4 Eq
05 Eq. 6.9-12,						AISC 358-
3.13						DG4 Eq.

119 Moment end plate (internal flange)

2.5	Flexural yielding	[Ton*m]	35.55	20.14	DL	0.57	DG16 Sec
2.5	No prying bolt moment strength	[Ton*m]	34.06	20.14	DL	0.59	DG16 Sec
2.5	Bolt rupture with prying moment strength	[Ton*m]	22.72	20.14	DL	0.89	DG16 Sec
2.5	Bolts shear	[Ton]	66.24	0.00	DL	0.00	Tables (7-
1..14)	Bolt bearing under shear load	[Ton]	167.22	16.00	DL	0.10	Eq. J3-6
3.12	Shear yielding	[Ton]	64.92	28.99	DL	0.45	DG4 Eq.
3.14,	Shear rupture	[Ton]	50.48	28.99	DL	0.57	DG4 Eq
05 Eq. 6.9-12,							AISC 358-
3.13							DG4 Eq.
	<u>Beam</u>						
	Web weld shear strength	[Ton]	37.12	16.00	DL	0.43	Eq. J2-4
	Web weld strength to reach yield stress	[Ton/m]	372.90	253.10	DL	0.68	Eq. J2-4,
							Eq. J4-1
	Shear yielding	[Ton]	60.74	16.00	DL	0.26	Eq. J4-3
	<u>Left side beam</u>						
	<u>Moment end plate (external flange)</u>						
2.5	Flexural yielding	[Ton*m]	31.70	0.00	DL	0.00	DG16 Sec
2.5	No prying bolt moment strength	[Ton*m]	25.56	0.00	DL	0.00	DG16 Sec
2.5	Bolt rupture with prying moment strength	[Ton*m]	20.42	0.00	DL	0.00	DG16 Sec
2.5	Bolts shear	[Ton]	44.16	16.00	DL	0.36	Tables (7-
1..14)	Bolt bearing under shear load	[Ton]	97.75	0.00	DL	0.00	Eq. J3-6
3.12	Shear yielding	[Ton]	64.92	42.99	DL	0.66	DG4 Eq.
3.14,	Shear rupture	[Ton]	50.48	42.99	DL	0.85	DG4 Eq
05 Eq. 6.9-12,							AISC 358-
3.13							DG4 Eq.
	<u>Moment end plate (internal flange)</u>						
2.5	Flexural yielding	[Ton*m]	35.55	20.14	DL	0.57	DG16 Sec
2.5	No prying bolt moment strength	[Ton*m]	34.06	20.14	DL	0.59	DG16 Sec
2.5	Bolt rupture with prying moment strength	[Ton*m]	22.72	20.14	DL	0.89	DG16 Sec
2.5	Bolts shear	[Ton]	66.24	0.00	DL	0.00	Tables (7-
1..14)	Bolt bearing under shear load	[Ton]	167.22	16.00	DL	0.10	Eq. J3-6
3.12	Shear yielding	[Ton]	64.92	28.99	DL	0.45	DG4 Eq.
3.14,	Shear rupture	[Ton]	50.48	28.99	DL	0.57	DG4 Eq
05 Eq. 6.9-12,							AISC 358-
3.13							DG4 Eq.
	<u>Beam</u>						
	Web weld shear strength	[Ton]	37.12	16.00	DL	0.43	Eq. J2-4
	Web weld strength to reach yield stress	[Ton/m]	372.90	253.10	DL	0.68	Eq. J2-4,
							Eq. J4-1
	Shear yielding	[Ton]	60.74	16.00	DL	0.26	Eq. J4-3
Global critical strength ratio			0.89				

Anexo 9.6 Rampa Acceso Sótano



ALCALDÍA MAYOR DE BOGOTÁ D.C.
SECRETARÍA DE EDUCACIÓN
SUBSECRETARÍA DE ACCESO Y PERMANENCIA
DIRECCIÓN DE CONSTRUCCIÓN Y CONSERVACIÓN DE ESTABLECIMIENTOS EDUCATIVOS

PROYECTO: COLEGIO BOITÁ
CONTRATO DE CONSULTORÍA 519 DE 27/12/2019



CONSULTOR: MC CONSTRUCCIONES Y CONSULTORÍAS SAS



CONTENIDO: **RAMPA ACCESO A SÓTANO MEMORIA ESTRUCTURAL**
ELABORADA POR: ING. WILLIAM JAVIER FAJARDO KUDEYRO
M.P. 7620282260 VLL

NOVIEMBRE 2020

TABLA DE CONTENIDO

	Pág.
1. FORMULACIÓN DEL PROYECTO.....	7
4.2 OBJETIVOS	7
General	7
Específicos	7
4.3 DESCRIPCIÓN DEL PROYECTO.....	7
2. ESPECIFICACIÓN DE LOS MATERIALES	10
3. DEFINICIÓN DE CARGAS DE DISEÑO	11
4. ANÁLISIS SÍSMICO.....	22
4.1 ZONA DE AMENAZA SÍSMICA DE ACUERDO CON LA MICROZONA SÍSMICA	22
4.2 COEFICIENTE DE IMPORTANCIA.....	24
4.3 TIPO DE PERFIL DE SUELO.....	26
4.4 ESPECTRO DE DISEÑO.....	27
Espectros de elásticos de aceleración	27
4.5 PARÁMETROS Y REQUISITOS DE DISEÑO	31
4.6 COMBINACIONES DE SERVICIO	32
4.7 COMBINACIONES DE DISEÑO	33
4.8 VERIFICACIÓN DE DEFLEXIONES.....	34
Verificación deflexiones rampa tipo 1	34
Verificación deflexiones rampa tipo 2	35
Verificación deflexiones rampa tipo 3	36
Verificación deflexiones rampa tipo 4	37
4.9 VERIFICACIÓN DE VIBRACIONES EN EL TABLERO DE LAS PASARELAS	37
Verificación vibraciones rampa tipo 1	39
Verificación vibraciones rampa tipo 2 y tipo 3	45
5 DISEÑO ESTRUCTURAL	53
6.1 DISEÑO DE APOYOS DE CONCRETO REGIONES D	54
Diseño de ménsulas cortas en vigas de anclaje de rampas	56
Diseño de ménsulas cortas en columnas de anclaje de rampas	70
6.2 DISEÑO DE ESTRUCTURA METALICA.....	87
6.3 DISEÑO CONEXIONES DE ESTRUCTURA METALICA	105
Diseño anclaje en ménsula.....	105
Diseño conexiones	112

LISTA DE FIGURAS

	Pág.
Figura 1 Modelo 3D	6
Figura 2 Asignación de Cargas de Tierra	7
Figura 3 Deflexión en muros	9
Figura 4 Deflexión viga en interior	10
Figura 5 Refuerzo Ast1 horizontal $0.085\text{cm}^2/\text{cm}$	11
Figura 6 Refuerzo Ast2 Vertical $0.085\text{cm}^2/\text{cm}$	12
Figura 7 Refuerzo Ast1 losa $0.018\text{cm}^2/\text{cm}$	13
Figura 8 Refuerzo Ast2 losa $0.068\text{cm}^2/\text{cm}$	14
Figura 9 Esfuerzo S13 en muros 260kPa	15
Figura 10 Esfuerzo S23 en muros 280kPa	16
Figura 11 Losa de entrepiso	17
Figura 12 Labels columnas	23
Figura 13 Índice de sobrefuerzo columnas	23

Lista de Tablas

	Pág.
Tabla 1 Resumen de diseño de vigas aéreas	19
Tabla 2 Resumen de diseño de columnas	24

Lista de Tablas

	Pág.
Tabla 1 Parámetros A_o , F_a y F_v para espectro de diseño $T_r=475$ años	27
Tabla 2 Parámetros de sitio Zona Aluvial-200	28
Tabla 3 valores recomendados de aceleración límite	38
Tabla 4 índices sobre esfuerzo rampa tipo 1	90
Tabla 5 índices sobre esfuerzo rampa tipo 2	92
Tabla 6 diseño viga compuesta rampa tipo 2	94
Tabla 7 índices sobre esfuerzo rampa tipo 3	95
Tabla 8 diseño viga compuesta rampa tipo 3	97
Tabla 9 índices sobre esfuerzo rampa tipo 4	99

MC CONSTRUCCIONES Y CONSULTORÍAS SAS**ALCALDÍA MAYOR DE BOGOTÁ D.C.**

SECRETARIA DE EDUCACIÓN

SUBSECRETARIA DE ACCESO Y PERMANENCIA

DIRECCIÓN DE CONSTRUCCIÓN Y CONSERVACIÓN DE ESTABLECIMIENTOS EDUCATIVOS

PROYECTO: COLEGIO BOITÁ

CONTRATO DE CONSULTORÍA 519 DE 27/12/2019

RAMPAS ACCESO A SÓTANO MEMORIA ESTRUCTURAL

DISEÑO Y CALCULO ESTRUCTURAL

ING. WILLIAM JAVIER FAJARDO K. MSc

**SANTIAGO DE CALI
AGOSTO DE 2020**

MC CONSTRUCCIONES Y CONSULTORÍAS SAS

ALCALDÍA MAYOR DE BOGOTÁ D.C.

SECRETARIA DE EDUCACIÓN

SUBSECRETARIA DE ACCESO Y PERMANENCIA

DIRECCIÓN DE CONSTRUCCIÓN Y CONSERVACIÓN DE ESTABLECIMIENTOS EDUCATIVOS

PROYECTO: COLEGIO BOITÁ

CONTRATO DE CONSULTORÍA 519 DE 27/12/2019

RAMPAS METÁLICAS MEMORIA ESTRUCTURAL

DISEÑO Y CALCULO ESTRUCTURAL

ING. WILLIAM JAVIER FAJARDO K. MSc

**SANTIAGO DE CALI
AGOSTO DE 2020**

2. Parámetros de Diseño:

Los parámetros de diseño presentes en el estudio de suelo fueron los siguientes:

PARAMETROS DE DISEÑO SUELO		Capa B1/B2: Limo arcilloso consistencia media		
Parámetro	Símbolo	Valor	Unid	
Cohesión efectiva	c'	0,30	Kg/cm ²	
Cohesión no drenada	C_u	0,50	Kg/cm ²	
Peso unitario húmedo	γ	1,8	T/m ³	
Angulo de fricción interna	ϕ	28	°	
Coefficiente empuje activo	K_a	0,36	Adim	
Coefficiente empuje pasivo	K_p	2,77	Adim	
Coefficiente de reposo	K_o	0,53	Adim	
Angulo fricción suelo-concreto	μ	20	°	
Módulo de elasticidad	E_s	60,0	Kg/cm ²	
Módulo de Poisson	ν	0,30	Adim	

Cargas Muerta: 4.0kN/m²
Carga Viva: 5.0kN/m²

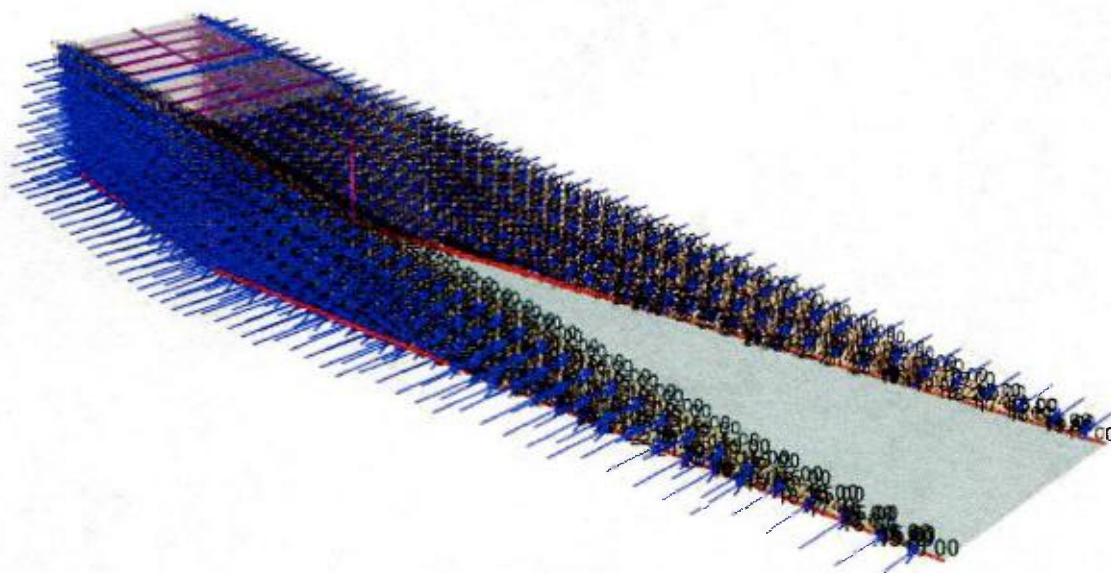


Figura 2 Asignación de Cargas de Tierra

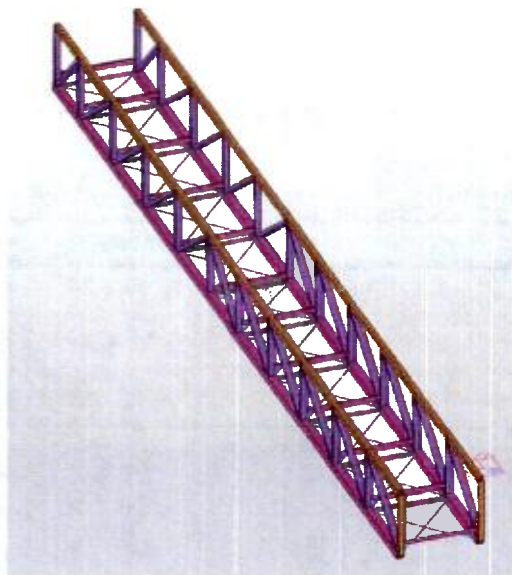


Figura 1 Modelo Estructural rampa tipo 1

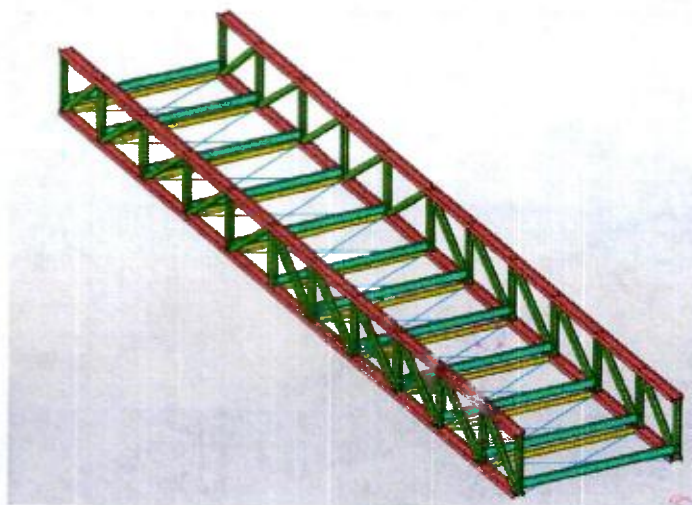


Figura 2 Modelo Estructural rampa tipo 2

5. Deflexiones en los muros:

Debido a los empujes de tierra, las deflexiones máximas fueron las siguientes:

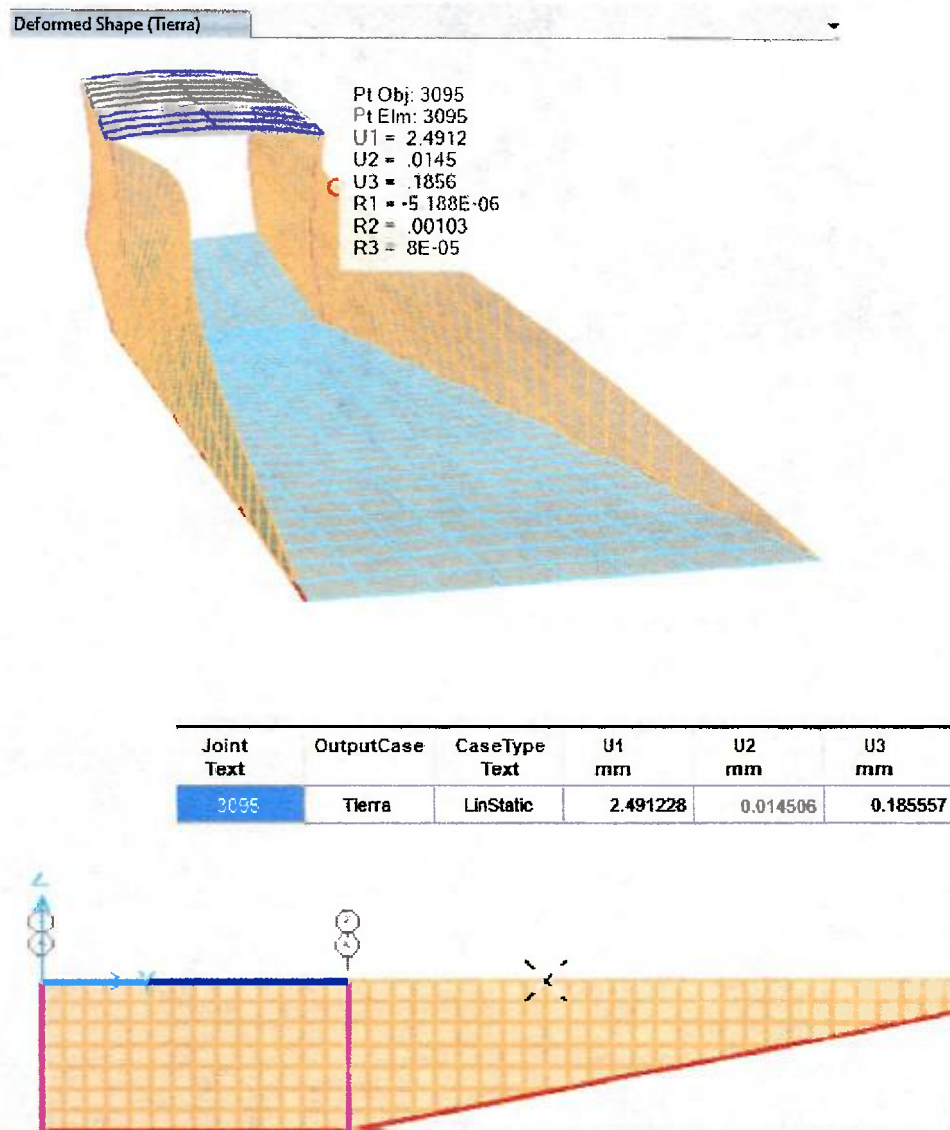


Figura 3 Deflexión en muros

Altura: $L=2.5\text{m}$
 $U_1=0.0025\text{m}$
 Esto es aproximadamente $L/1000$, **CUMPLE**

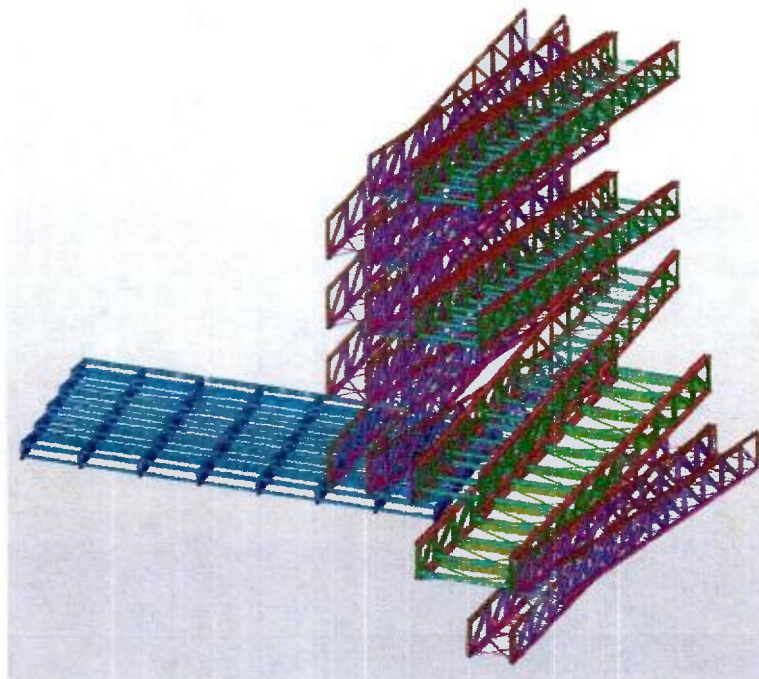


Figura 5 Modelo BIM estructural rampas

2. ESPECIFICACIÓN DE LOS MATERIALES

Módulo de Elasticidad del Concreto

La NSR-10 permite el uso de dos correlaciones para el cálculo del módulo de elasticidad, para la aplicación de estas es necesario conocer la resistencia y masa unitaria del concreto. Dichas correlaciones se presentan en las ecuaciones (1) y (2).

$$E_c = 4700\sqrt{f'_c} \quad (1)$$

$$E_c = W_c^{1.5} 0,043 \sqrt{f'_c} \quad (2)$$

Dónde:

f'_c = Resistencia del concreto en (MPa)

W_c = Masa unitario (kg/m^3)

Una vez obtenido el módulo de elasticidad por medio de las ecuaciones (1) y (2), se procede a determinar los valores promedios teniendo en cuenta la situación más crítica, la cual se presenta con la ecuación (1).

7. Diseño de los Muros:

7.1 Sentido Horizontal:

Espesor:	30 cm
Recubrimiento:	7.5 cm
As mínimo= $0.0020 \times 30 \times 100 =$	4.5 cm ² /m
As. Requerido= $0.085 \times 100 =$	8.5 cm ² /m
Usar: #4@15cm dos capas= $1.29/0.15 =$	8.6 cm ² /m

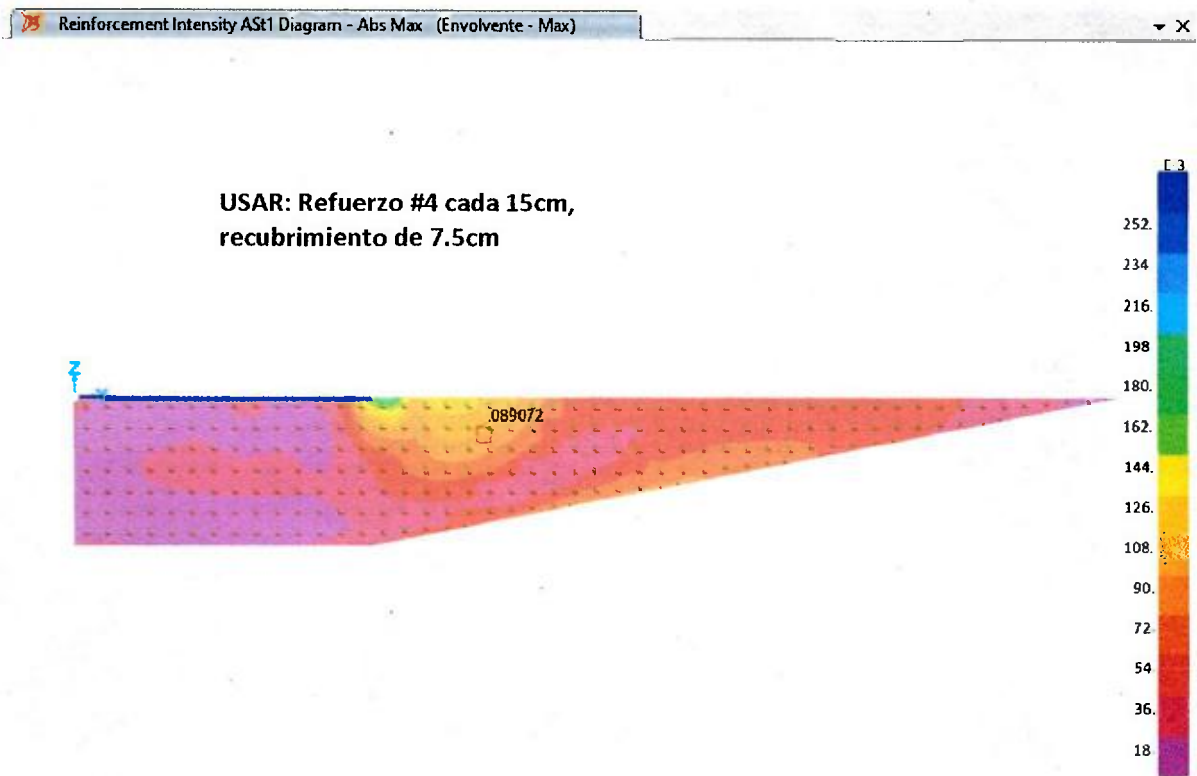


Figura 5 Refuerzo Ast1 horizontal 0.085cm²/cm

EVALUACIÓN DE CARGAS VIVAS Y MUERTAS

Según la información arquitectónica, la estructura cuenta con diferentes niveles y espacios educativos. De acuerdo con el documento **Lineamiento Básicos de Construcción de Edificaciones de Construcciones Escolares 2017**, en el Capítulo 6. **Especificaciones Básicas de Construcción**, definido por la Secretaria de Educación Distrital de la Ciudad de Bogotá D.C, en el. Se tuvieron en cuenta los siguientes cuadros de especificaciones:

DEPENDENCIA	PISOS	OBSERVACIONES	MUROS	OBSERVACIONES	CIELOS RASOS	G/ESCOBAS	VARIOS
EDUCACIÓN PREESCOLAR							
AULA PRIMERA INFANCIA	A5		B1		C1	D5	E1
LUDOTECA	A5		B1		C1	D5	
BAÑOS	A4	1	B2	2/3/4	C1	D2	
RECREACIÓN EXTERIOR	A2/A11 A12/A13		B1			D1	

7.3 Losa de Fondo

Sentido Corto

Espesor	30 cm
Recubrimiento	7.5 cm
As.minimo= $0.0020 \cdot 30 \cdot 100 =$	4.5 cm ² /m
As. requerido	1.8 cm ² /m
Usar: #4@15cm dos capas	8.6 cm ² /m
Viga de borde de 30x30cm con 4#4	
Estribos #3 cada	7.5 cm

Reinforcement Intensity Ast1 Diagram - Abs Max (Envolvente - Max)

Dos vigas embebidas de 30x30 con 4#4 y E#3@7.5cm

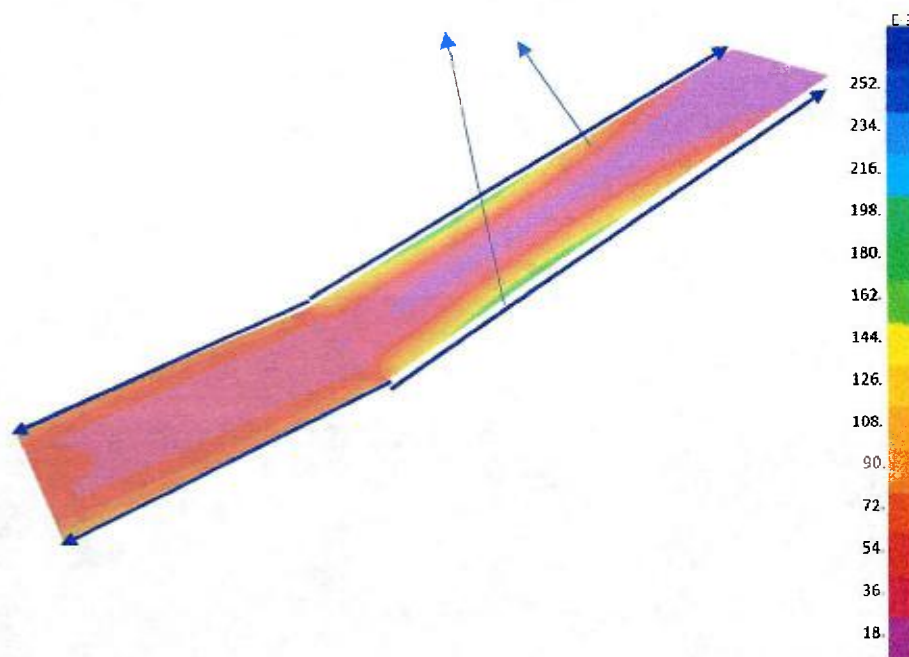


Figura 7 Refuerzo Ast1 losa 0.018cm²/cm

e= 30cm



Refuerzo #4 cada 15cm, arriba y abajo, recubrimiento de 7.5cm

DEPENDENCIA	PISOS	OBSERVACIONES	MUROS	OBSERVACIONES	CIELOS RASOS	G/ESCOBAS	VARIOS
CENTRO INTEGRADO DE RECURSOS							
BIBLIOTECA	A4		B1		C1	D4	E2
AULA DE INFORMÁTICA	A4		B1		C1	D4	
SOCIALIZACIÓN Y BIENESTAR							
AULA MÚLTIPLE	A4		B1		C1	D4	
ATENCIÓN DE PÚBLICO COMESTIBLES	A4		B1		C1	D4	E2
BAÑOS	A4	1	B2	2/3/4	C1	D2	
EMISORA	A4		B1		C1	D4	
ADMINISTRACIÓN							
RECTORÍA	A3/A4		B1		C1	D3/D4	
SECRETARÍA	A3/A4		B1		C1	D3/D4	E2
BAÑO PRIVADO	A6		B2		C1		
ORIENTACIÓN Y PADRES DE FAMILIA	A3/A4		B1		C1	D3/D4	
COORDINACIÓN ACADÉMICA Y PROFESORES	A3/A4		B1		C1	D3/D	
BAÑOS PROFESORES	A4	1	B2	2/3/4	C1	D2	
ADMINISTRACIÓN ARCHIVO Y FOTOCOPIADO	A3/A4		B1		C1	D3/D4	
ENFERMERÍA	A4	1	B1		C1	D4	
BAÑOS ADMINISTRACIÓN Y ENFERMERÍA	A6		B2		C1		
SERVICIOS GENERALES							
BODEGA	A3		B1		C1	D3	
ALMACEN	A3		B1		C1	D3	
EQUIPOS	A3		B1		C1	D3	
BASURAS	A4	1	B2		C1	D2	
PORTERÍA	A3		B1		C1	D3	E2
BAÑOS Y VESTIER PERSONAL	A4	1	B2		C1	D2	

7.4 Revisión Cortante:

$$V_c = 0.17\lambda\sqrt{f'_c}b_wd \quad (C.11-3)$$

$$\phi V_c = 674.67 \text{ kN/m}^2$$

$$s_{23.\max} = 260 \text{ kN/m}^2$$

$\phi V_c > s_{23.\max}$ Cumple

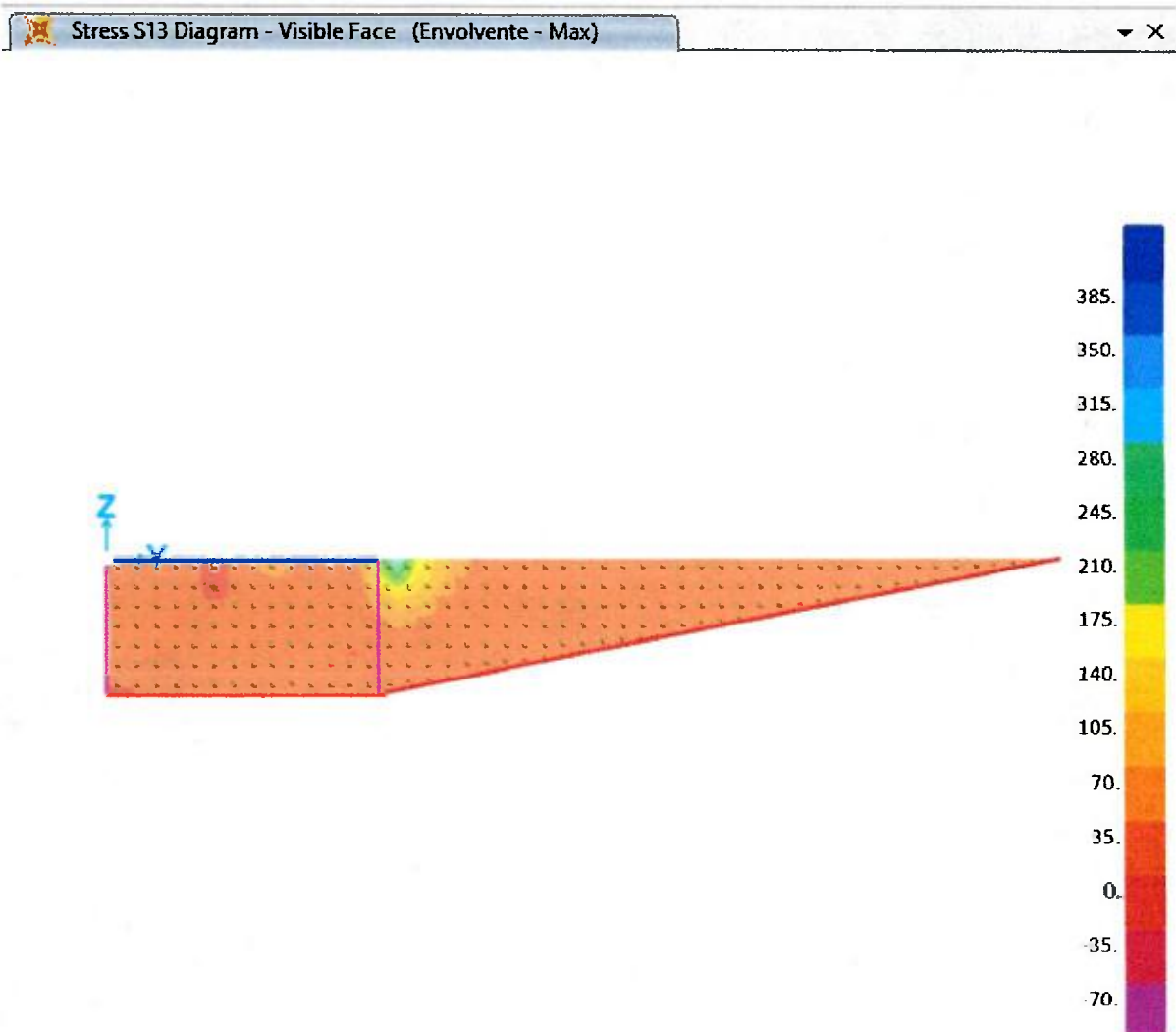


Figura 9 Esfuerzo S13 en muros 260kPa

- A3** Pisos en arcilla cocida y vitrificada o gres
 Tablón Cuarto x 26
 Tabletas y tabloncillos de gres de diferentes medidas
- A4** Baldosín de granito vibropresado de 0.30 x 0.30 o 0.33 x 0.33 ms.
 Grano No 1. Colores claros
- A5** Baldosa de caucho para tráfico pesado.
- A6** Baldosín de porcelana o cerámica de 0.20 x 0.20 o de 0.30 x 0.30 ms.
 Fabricación mediante proceso de monococción, alta resistencia, bajo nivel de absorción. Tráfico 4.
- A7** Pavimento en concreto reforzado
- A8** Gradadas en ladrillo tolete moldurado
 Gradadas en gravilla lavada
 Gradadas en gravilla lavada y tableta de gres
 Gradadas en granito pulido con pirlán de cobre y cintas antideslizantes
 Enchapes en tabloncillos de gres con perfil para gradadas.
- A9** Gradadas en ladrillo tolete
 Gradadas en concreto lavado
- A10** Concreto escobillado
 Concreto lavado
- A11** Piso en deck sintético en PVC
- A12** Recubrimiento sintético de alta resistencia (caucho)
- A13** El césped

8. Diseño de vigas aéreas

Losa aérea: $L/16=3800\text{mm}/16=250\text{mm}$; Usar $H=35\text{cm}$

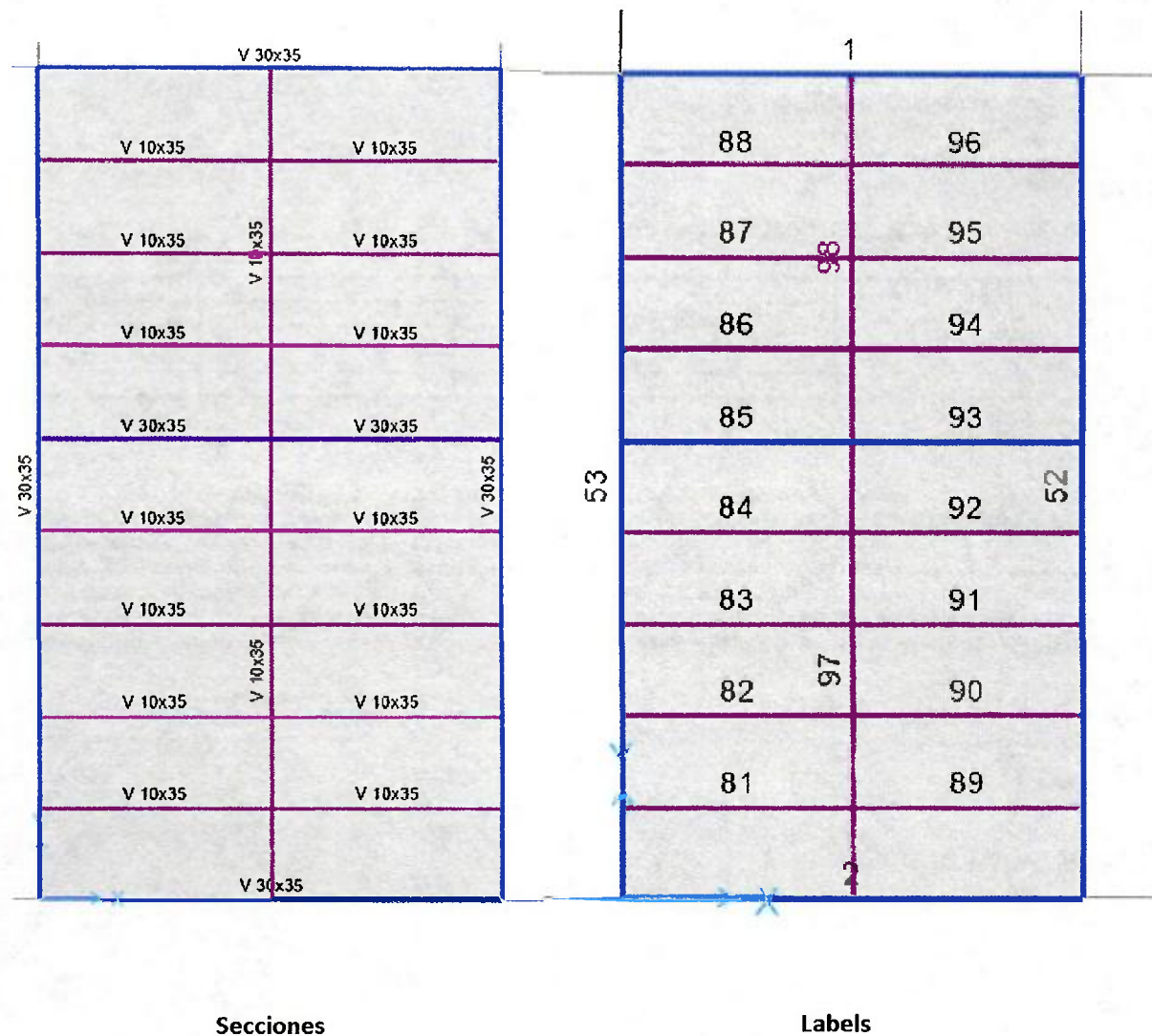


Figura 11 Losa de entrepiso

Cargas Muertas

Se utilizará una losa de metaldeck de 2" calibre 18 con altura de 11 cm de losa completa con concreto y 2 cm de espesor de acabado de piso en concreto

Componente	Carga (kN/m ²) m ² de área en planta	Carga (kgf/m ²) m ² de área en planta
Pisos y acabados		
Acabado de piso en concreto	0.0200 (por mm de espesor)	20 (por cm de espesor)

En la plataforma se pondrán = 40 kg/m²

Las barandas laterales se diseñan para que soporten el peso de teja sencilla de aluminio o zinc con peso con accesorios de 20 kg/m²

Cargas vivas

Se usan las cargas que se describen en la tabla B.4.2.1-1

Educativos	Salones de clase	2.0	200
	Corredores y escaleras	5.0	500
	Bibliotecas		
	Salones de lectura	2.0	200
	Estanterías	7.0	700

B.4.2.2 — EMPUJE EN PASAMANOS Y ANTEPECHOS — Las barandas, pasamanos de escaleras y balcones, y barras auxiliares tanto exteriores como interiores, y los antepechos deben diseñarse para que resistan una fuerza horizontal de 1.00 kN/m (100 kgf/m) aplicada en la parte superior de la baranda, pasamanos o antepecho y deben ser capaces de transferir esta carga a través de los soportes a la estructura. Para viviendas unifamiliares, la carga mínima es de 0.4 kN/m. (40 kgf/m). En estadios y coliseos esa carga mínima horizontal de barandas y antepechos no será menor de 2.5 kN/m (250 kgf/m). En estos y otros escenarios públicos las barandas deberán ser sometidas a pruebas de carga, las cuales deben ser dirigidas y documentadas por el Supervisor Técnico antes de ser puestas en servicio.

Tabla 1 Resumen de diseño de vigas aéreas

TABLE: Concrete Deck 3 - Beam Summary Data - ACI 318-14									
Frame Text	DesignSect Text	DesignType Text	Location mm	FTopCombo Text	FTopArea mm2	FBotArea mm2	VRebar mm2/mm	TLngArea mm2	TTnRebar mm2/mm
52	V 30x35	Beam	0	B.2.4-7.8	0.00	9.89	0.00	0.00	0.00
52	V 30x35	Beam	493	B.2.4-2	13.82	2.92	0.00	0.00	0.00
52	V 30x35	Beam	493	B.2.4-2	12.19	2.92	0.00	0.00	0.00
52	V 30x35	Beam	767	B.2.4-2	3.68	2.92	0.00	0.00	0.00
52	V 30x35	Beam	767	B.2.4-2	3.89	2.92	0.25	0.00	0.00
52	V 30x35	Beam	986	B.2.4-2	6.68	2.92	0.25	0.00	0.00
52	V 30x35	Beam	986	B.2.4-2	4.64	2.92	0.00	0.00	0.00
52	V 30x35	Beam	1479	B.2.4-2 (Sp)	2.92	2.92	0.00	0.00	0.00
52	V 30x35	Beam	1479	B.2.4-2 (Sp)	2.92	2.92	0.25	0.00	0.00
52	V 30x35	Beam	1533	B.2.4-2 (Sp)	2.92	2.92	0.25	0.00	0.00
52	V 30x35	Beam	1533	B.2.4-2 (Sp)	2.92	2.92	0.00	0.00	0.00
52	V 30x35	Beam	1971	B.2.4-2	3.92	2.92	0.00	0.00	0.00
52	V 30x35	Beam	1971	B.2.4-2	4.39	2.92	0.00	0.00	0.00
52	V 30x35	Beam	2300	B.2.4-2 (Sp)	2.92	2.92	0.00	0.00	0.00
52	V 30x35	Beam	2300	B.2.4-2 (Sp)	2.92	2.92	0.25	0.00	0.00
52	V 30x35	Beam	2464	B.2.4-2	4.14	2.92	0.25	0.00	0.00
52	V 30x35	Beam	2464	B.2.4-2	3.56	2.92	0.00	0.00	0.00
52	V 30x35	Beam	2957	B.2.4-2	6.44	2.92	0.00	0.00	0.00
52	V 30x35	Beam	2957	B.2.4-2	13.70	2.92	0.25	0.00	0.00
52	V 30x35	Beam	3067	B.2.4-2	11.84	2.92	0.25	0.00	0.00
52	V 30x35	Beam	3067	B.2.4-2	11.85	2.92	0.00	0.00	0.00
52	V 30x35	Beam	3450	B.2.4-2	24.60	2.92	0.00	0.00	0.00
52	V 30x35	Beam	3450	B.2.4-2	29.57	2.92	0.25	0.00	0.00
52	V 30x35	Beam	3833	B.2.4-2 (Sp)	2.92	108.08	0.25	0.00	0.00
52	V 30x35	Beam	3833	B.2.4-2 (Sp)	2.92	109.50	0.32	405.05	0.43
52	V 30x35	Beam	3943	B.2.4-2	7.28	2.92	0.32	405.05	0.43
52	V 30x35	Beam	3943	B.2.4-2 (Sp)	2.92	4.39	0.00	0.00	0.00
52	V 30x35	Beam	4436	B.2.4-2	20.67	2.92	0.00	0.00	0.00
52	V 30x35	Beam	4436	B.2.4-2	14.80	2.92	0.25	0.00	0.00
52	V 30x35	Beam	4600	B.2.4-2	6.81	2.92	0.25	0.00	0.00
52	V 30x35	Beam	4600	B.2.4-2	6.81	2.92	0.00	0.00	0.00
52	V 30x35	Beam	4929	B.2.4-2	7.12	2.92	0.00	0.00	0.00
52	V 30x35	Beam	4929	B.2.4-2	4.59	2.92	0.00	0.00	0.00
52	V 30x35	Beam	5367	B.2.4-2 (Sp)	2.92	2.92	0.00	0.00	0.00
52	V 30x35	Beam	5367	B.2.4-2 (Sp)	2.92	2.92	0.25	0.00	0.00
52	V 30x35	Beam	5421	B.2.4-2	3.62	2.92	0.25	0.00	0.00
52	V 30x35	Beam	5421	B.2.4-2 (Sp)	2.92	2.92	0.00	0.00	0.00
52	V 30x35	Beam	5914	B.2.4-2	3.40	2.92	0.00	0.00	0.00
52	V 30x35	Beam	5914	B.2.4-2	4.49	2.92	0.25	0.00	0.00
52	V 30x35	Beam	6133	B.2.4-2 (Sp)	2.92	3.04	0.25	0.00	0.00
52	V 30x35	Beam	6133	B.2.4-2 (Sp)	2.92	2.92	0.00	0.00	0.00
52	V 30x35	Beam	6407	B.2.4-2	5.78	2.92	0.00	0.00	0.00
52	V 30x35	Beam	6407	B.2.4-2	6.21	2.92	0.00	0.00	0.00
52	V 30x35	Beam	6900	B.2.4-7.8	0.00	11.70	0.00	0.00	0.00
53	V 30x35	Beam	0	B.2.4-7.8	0.00	11.70	0.00	0.00	0.00
53	V 30x35	Beam	493	B.2.4-2	6.21	2.92	0.00	0.00	0.00
53	V 30x35	Beam	493	B.2.4-2	5.78	2.92	0.00	0.00	0.00
53	V 30x35	Beam	767	B.2.4-2 (Sp)	2.92	2.92	0.00	0.00	0.00
53	V 30x35	Beam	767	B.2.4-2 (Sp)	2.92	3.04	0.25	0.00	0.00
53	V 30x35	Beam	986	B.2.4-2	4.49	2.92	0.25	0.00	0.00
53	V 30x35	Beam	986	B.2.4-2	3.40	2.92	0.00	0.00	0.00
53	V 30x35	Beam	1479	B.2.4-2 (Sp)	2.92	2.92	0.00	0.00	0.00
53	V 30x35	Beam	1479	B.2.4-2	3.62	2.92	0.25	0.00	0.00
53	V 30x35	Beam	1533	B.2.4-2 (Sp)	2.92	2.92	0.25	0.00	0.00
53	V 30x35	Beam	1533	B.2.4-2 (Sp)	2.92	2.92	0.00	0.00	0.00
53	V 30x35	Beam	1971	B.2.4-2	4.59	2.92	0.00	0.00	0.00
53	V 30x35	Beam	1971	B.2.4-2	7.12	2.92	0.00	0.00	0.00

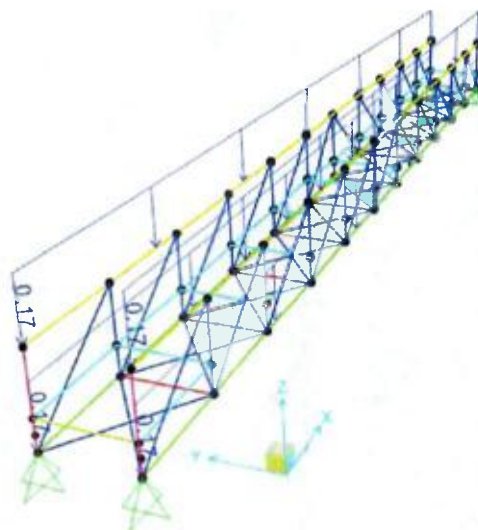


Figura 8 aplicación carga muerta barandas rampa tipo 1

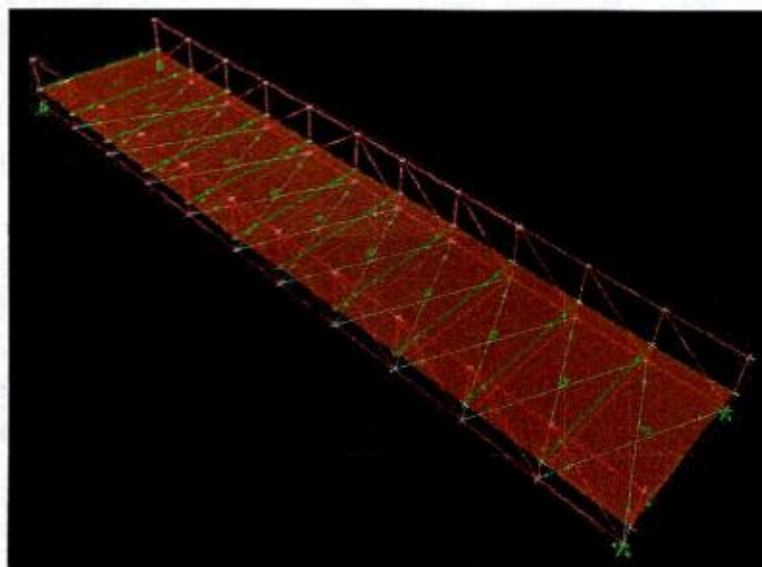


Figura 9 aplicación carga viva rampa tipo 2 y 3

TABLE: Concrete Design 2 - Beam Summary Data - ACI 318-14

Frame Text	DesignSect Text	DesignType Text	Location mm	FTopCombo Text	FTopArea mm2	FBotArea mm2	VRebar mm2/mm	TLngArea mm2	TTrnRebar mm2/mm
86	V 10x35	Beam	1900	B.2.4-2	75.60	37.47	0.00	0.00	0.00
87	V 10x35	Beam	0	B.2.4-7.8	40.52	27.43	0.00	0.00	0.00
87	V 10x35	Beam	475	B.2.4-7.8	42.92	22.05	0.00	0.00	0.00
87	V 10x35	Beam	950	B.2.4-7.8	47.95	17.14	0.00	0.00	0.00
87	V 10x35	Beam	1425	B.2.4-7.8	55.65	17.14	0.00	0.00	0.00
87	V 10x35	Beam	1900	B.2.4-2	69.38	34.41	0.00	0.00	0.00
88	V 10x35	Beam	0	B.2.4-7.8	46.30	24.55	0.00	0.00	0.00
88	V 10x35	Beam	475	B.2.4-7.8	45.40	20.44	0.00	0.00	0.00
88	V 10x35	Beam	950	B.2.4-7.8	47.14	15.18	0.00	0.00	0.00
88	V 10x35	Beam	1425	B.2.4-7.8	51.53	15.18	0.00	0.00	0.00
88	V 10x35	Beam	1900	B.2.4-2	61.35	30.46	0.00	0.00	0.00
89	V 10x35	Beam	0	B.2.4-2	64.93	32.22	0.00	0.00	0.00
89	V 10x35	Beam	475	B.2.4-7.8	52.99	16.05	0.00	0.00	0.00
89	V 10x35	Beam	950	B.2.4-7.8	45.39	16.05	0.00	0.00	0.00
89	V 10x35	Beam	1425	B.2.4-7.8	40.45	24.18	0.00	0.00	0.00
89	V 10x35	Beam	1900	B.2.4-7.8	38.16	28.66	0.00	0.00	0.00
90	V 10x35	Beam	0	B.2.4-2	73.91	36.64	0.00	0.00	0.00
90	V 10x35	Beam	475	B.2.4-7.8	58.94	18.24	0.00	0.00	0.00
90	V 10x35	Beam	950	B.2.4-7.8	48.90	18.24	0.00	0.00	0.00
90	V 10x35	Beam	1425	B.2.4-7.8	41.54	24.44	0.00	0.00	0.00
90	V 10x35	Beam	1900	B.2.4-7.8	36.83	29.97	0.00	0.00	0.00
91	V 10x35	Beam	0	B.2.4-2	73.34	36.36	0.00	0.00	0.00
91	V 10x35	Beam	475	B.2.4-7.8	58.76	18.10	0.00	0.00	0.00
91	V 10x35	Beam	950	B.2.4-7.8	49.47	18.10	0.00	0.00	0.00
91	V 10x35	Beam	1425	B.2.4-7.8	42.85	24.16	0.00	0.00	0.00
91	V 10x35	Beam	1900	B.2.4-7.8	38.89	29.55	0.00	0.00	0.00
92	V 10x35	Beam	0	B.2.4-2	76.72	38.02	0.00	0.00	0.00
92	V 10x35	Beam	475	B.2.4-7.8	60.57	18.93	0.00	0.00	0.00
92	V 10x35	Beam	950	B.2.4-7.8	50.32	18.93	0.00	0.00	0.00
92	V 10x35	Beam	1425	B.2.4-7.8	42.76	23.78	0.00	0.00	0.00
92	V 10x35	Beam	1900	B.2.4-7.8	37.85	29.11	0.00	0.00	0.00
93	V 30x35	Beam	0	B.2.4-2	193.47	96.01	0.00	0.00	0.00
93	V 30x35	Beam	475	B.2.4-7.8	163.46	47.83	0.00	0.00	0.00
93	V 30x35	Beam	950	B.2.4-7.8	143.28	47.83	0.00	0.00	0.00
93	V 30x35	Beam	1425	B.2.4-7.8	131.07	65.94	0.00	0.00	0.00
93	V 30x35	Beam	1900	B.2.4-7.8	126.78	75.30	0.00	0.00	0.00
94	V 10x35	Beam	0	B.2.4-2	75.60	37.47	0.00	0.00	0.00
94	V 10x35	Beam	475	B.2.4-7.8	59.51	18.65	0.00	0.00	0.00
94	V 10x35	Beam	950	B.2.4-7.8	49.48	18.65	0.00	0.00	0.00
94	V 10x35	Beam	1425	B.2.4-7.8	42.13	22.79	0.00	0.00	0.00
94	V 10x35	Beam	1900	B.2.4-7.8	37.43	27.92	0.00	0.00	0.00
95	V 10x35	Beam	0	B.2.4-2	69.38	34.41	0.00	0.00	0.00
95	V 10x35	Beam	475	B.2.4-7.8	55.65	17.14	0.00	0.00	0.00
95	V 10x35	Beam	950	B.2.4-7.8	47.95	17.14	0.00	0.00	0.00
95	V 10x35	Beam	1425	B.2.4-7.8	42.92	22.05	0.00	0.00	0.00
95	V 10x35	Beam	1900	B.2.4-7.8	40.52	27.43	0.00	0.00	0.00
96	V 10x35	Beam	0	B.2.4-2	61.35	30.46	0.00	0.00	0.00
96	V 10x35	Beam	475	B.2.4-7.8	51.53	15.18	0.00	0.00	0.00
96	V 10x35	Beam	950	B.2.4-7.8	47.14	15.18	0.00	0.00	0.00
96	V 10x35	Beam	1425	B.2.4-7.8	45.40	20.44	0.00	0.00	0.00
96	V 10x35	Beam	1900	B.2.4-7.8	46.30	24.55	0.00	0.00	0.00
97	V 10x35	Beam	0	B.2.4-1	1.63	2.49	0.00	0.00	0.00
97	V 10x35	Beam	383	B.2.4-2 (Sp)	1.17	2.68	0.00	0.00	0.00
97	V 10x35	Beam	767	B.2.4-2 (Sp)	1.17	1.18	0.00	0.00	0.00
97	V 10x35	Beam	767	B.2.4-2 (Sp)	1.17	1.58	0.00	0.00	0.00
97	V 10x35	Beam	1150	B.2.4-2 (Sp)	1.17	1.17	0.00	0.00	0.00
97	V 10x35	Beam	1533	B.2.4-2	4.32	1.17	0.00	0.00	0.00
97	V 10x35	Beam	1533	B.2.4-2	3.88	1.17	0.00	0.00	0.00
97	V 10x35	Beam	1917	B.2.4-2	3.19	1.17	0.00	0.00	0.00
97	V 10x35	Beam	2300	B.2.4-2	4.74	1.17	0.00	0.00	0.00

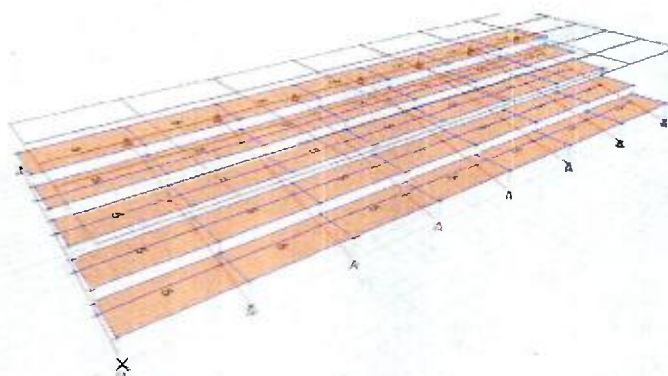


Figura 12 aplicación carga viva rampa tipo 4

4. ANÁLISIS SÍSMICO

4.1 ZONA DE AMENAZA SÍSMICA DE ACUERDO CON LA MICROZONA SÍSMICA

Según el decreto 523 del 16 diciembre de 2010, por el cual se adopta la microzonificación sísmica de Bogotá D.C y se definen sus respectivas curvas y parámetros de diseño estructural sísmo resistente. A partir de la información presente en el Estudio de Microzonificación, se construyeron los espectros elásticos de aceleración, y Curva elástica de Umbral de daño.

De acuerdo con la ubicación del proyecto, éste se encuentra en la Micro-Zona: Aluvial 200

- Dirección del predio: Calle 45sur N.º 72Q-20
- Barrio: Boitá
- Localidad: 8 Kennedy.

El proyecto está localizado a una distancia aproximada de 826m de la Microzona más cercana Aluvial-100. Por lo tanto, no se hace necesario hacer un promedio de coeficientes y curvas debido a que esta distancia es mayor a 100m, tal como lo recomienda el decreto. Los mapas de localización y de microzonificación de la ciudad de Bogotá D.C, se consultaron a través de los mapas interactivos del sistema de Infraestructura de Datos Espaciales para el Distrito Capital IDECA. A partir del portal Geoportal Gestión de Riesgos y Atención de Emergencias.

Esta información se puede consultar en los siguientes enlaces:

<https://www.ideca.gov.co/recursos/aplicaciones/geoportal-gestion-de-riesgos-y-atencion-de-emergencias>
<https://idiger.maps.arcgis.com/apps/webappviewer/index.html?id=fa4b277533584c3a95a9208b4d542e19>

A continuación, se presenta la localización general en el mapa de microzonificación sísmica de la ciudad de Bogotá D.C.

9. Revisión de Columnas:

Sección: 30x35cm, refuerzo: 4#6

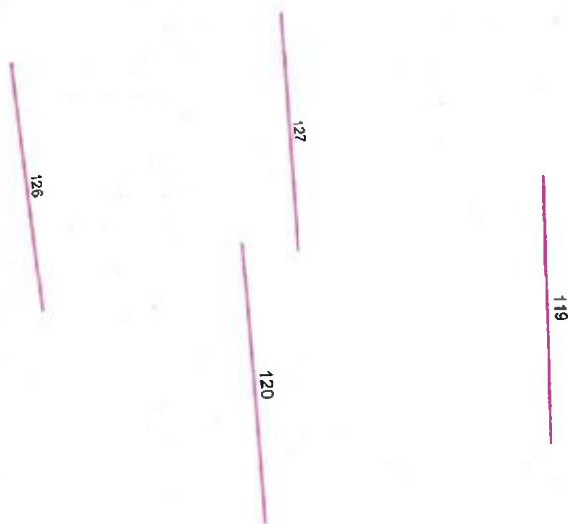


Figura 12 Labels columnas

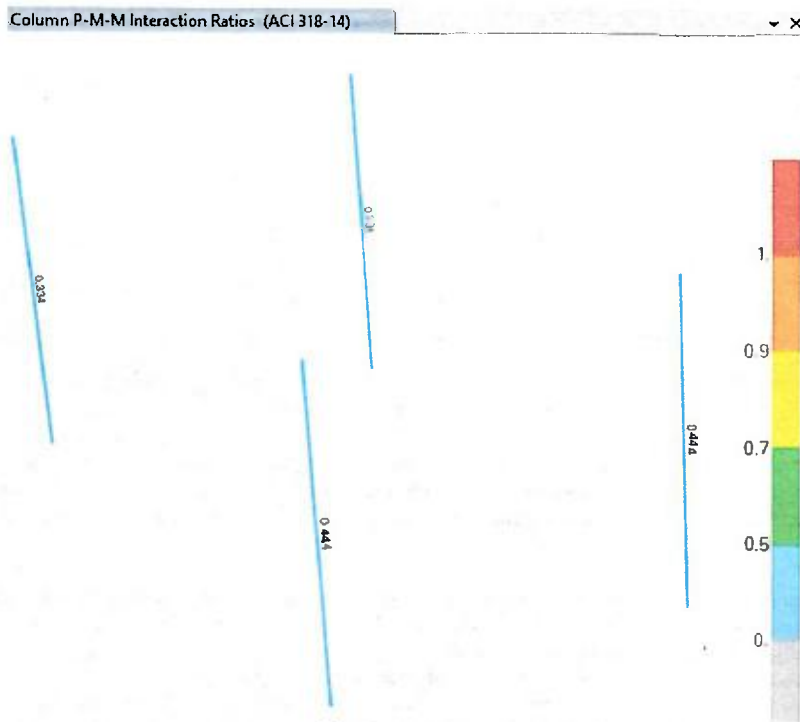


Figura 13 Índice de sobrefuerzo columnas



Figura 15 Zona de respuesta sísmica Aluvial-200

4.2 COEFICIENTE DE IMPORTANCIA

A.2.5.1 — GRUPOS DE USO — Todas las edificaciones deben clasificarse dentro de uno de los siguientes Grupos de Uso:

- A.2.5.1.4.- Grupo de Uso I
- A.2.5.1.3.- Grupo de Uso II
- A.2.5.1.2.- Grupo de Uso III
- A.2.5.1.1.- Grupo de Uso IV

La edificación corresponde a una institución educativa, por lo tanto, la edificación pertenece al **Grupo de Uso III- Edificaciones de atención a la comunidad**, tal como se describe a continuación:

A.2.5.1.2 — Grupo III — Edificaciones de atención a la comunidad — Este grupo comprende aquellas edificaciones, y sus accesos, que son indispensables después de un temblor para atender la emergencia y preservar la salud y la seguridad de las personas, exceptuando las incluidas en el grupo IV. Este grupo debe incluir:

- (a) Estaciones de bomberos, defensa civil, policía, cuarteles de las fuerzas armadas, y sedes de las oficinas de prevención y atención de desastres,
- (b) Garajes de vehículos de emergencia,
- (c) Estructuras y equipos de centros de atención de emergencias,
- (d) Guarderías, escuelas, colegios, universidades y otros centros de enseñanza,
- (e) Aquellas del grupo II para las que el propietario desee contar con seguridad adicional, y
- (f) Aquellas otras que la administración municipal, distrital, departamental o nacional designe como tales.