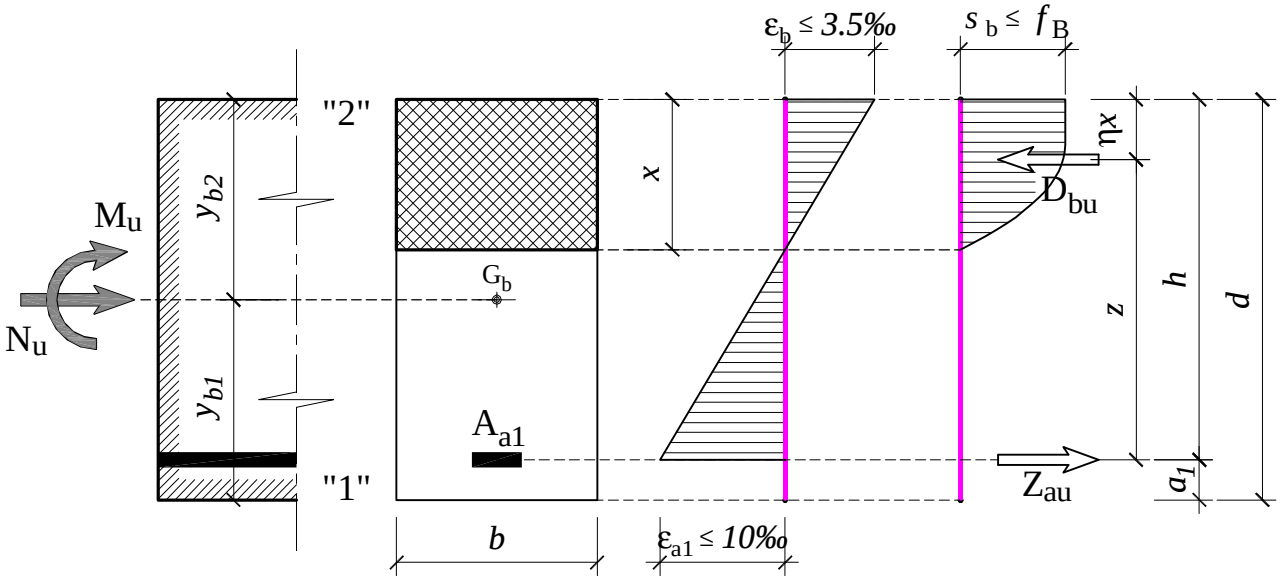
DIMENZIONISANJE PRAVOUGAONIH POPREČNIH PRESEKA NAPREGNUTIH NA PRAVO SLOŽENO SAVIJANJE



G_b - tačka u preseku koja određuje položaj sistemne linije (linije u odnosu na koju su sračunati statički uticaji M i N). Kod simetričnih preseka (pravougaoni, I) poklapa se sa težištem, u ostalim slučajevima je, po pravilu, u polovini visine preseka;

"1" - oznaka za ZATEGNUTU (eventualno: manje pritisnutu) ivicu preseka;

"2" - oznaka za PRITISNUTU (eventualno: manje zategnutu) ivicu preseka;

M_u, N_u - granični računski moment savijanja i normalna sila, sračunati množenjem eksploatacionih vrednosti presečnih sila (M_i, N_i) odgovarajućim vrednostima parcijalnih koeficijenata sigurnosti $\gamma_{u,i}$:

$$M_u = \sum_i \gamma_{u,i} \times M_i \quad (i=g,p,\Delta)$$

$$N_u = \sum_i \gamma_{u,i} \times N_i$$

b, d - širina i visina poprečnog preseka;

y_{b1}, y_{b2} - položaj težišta betonskog dela preseka u odnosu na zategnutu, odnosno pritisnutu, ivicu preseka:

$$y_{b2} = d - y_{b1}$$

A_{a1}, A_{a2} - površina zategnute, odnosno pritisnute armature u preseku;

a_1, a_2 - položaj težišta zategnute armature u odnosu na zategnutu (ivica "1"), odnosno pritisnutu ivicu preseka (ivica "2");

y_{a1}, y_{a2} - položaj težišta zategnute, odnosno pritisnute, armature u odnosu G_b:

$$y_{a1} = y_{b1} - a_1 \;;\; y_{a2} = y_{b2} - a_2$$

h - ***statička visina preseka*** - rastojanje od težišta zategnute armature do krajnje pritisnute ivice preseka:

$$h = d - a_1$$

ε_b, ε_{a1} - dilatacija betona, odnosno zategnute armature. U skladu sa uvedenom notacijom, $\varepsilon_b \equiv \varepsilon_{b2}$. Da bi uslov loma bio zadovoljen, potrebno je da bar jedna od njih dostigne graničnu vrednost ($\varepsilon_b = 3.5‰$ ili $\varepsilon_{a1} = 10‰$[1]).

x - visina pritisnute zone betona:

$$x = s \times h$$

s - bezdimenzioni koeficijent položaja neutralne linije, dat u tabelama za dimenzionisanje. S obzirom na važenje *Bernoulli*-eve hipoteze ravnih preseka, dijagram dilatacija je linearan, pa se položaj neutralne linije može odrediti iz proporcije:

$$\frac{x}{h-x} = \frac{\varepsilon_b}{\varepsilon_{a1}} \Rightarrow s = \frac{x}{h} = \frac{\varepsilon_b}{\varepsilon_b + \varepsilon_{a1}} = \frac{1}{1+\frac{\varepsilon_{a1}}{\varepsilon_b}}$$

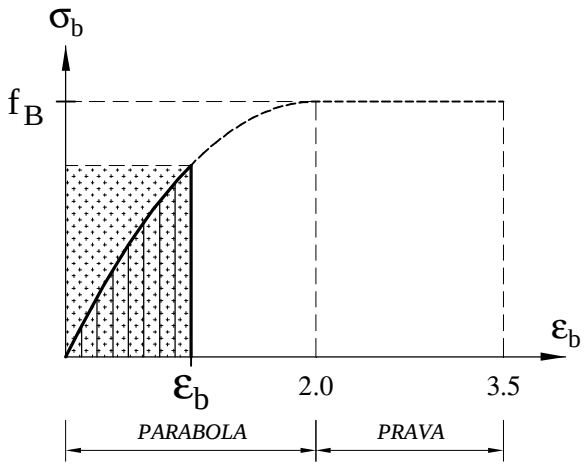
D_{bu} - sila pritiska u betonu, određena izrazom:

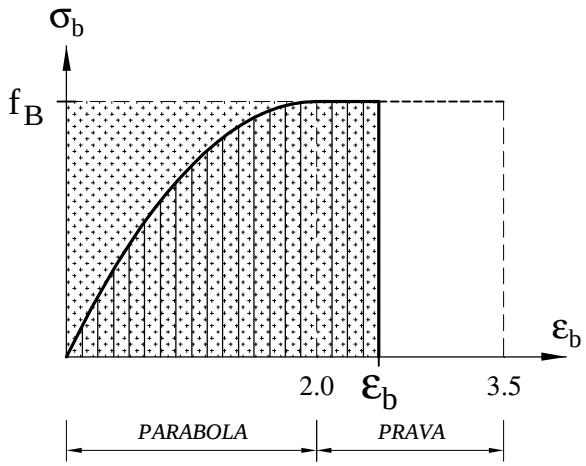
$$D_{bu} = \alpha_b \cdot b \cdot x \cdot f_B = \alpha_b \cdot s \cdot b \cdot h \cdot f_B$$

α_b - koeficijent punoće dijagrama napona pritiska u betonu, dat u tabelama za dimenzionisanje. Za Pravilnikom definisani računski dijagram betona u obliku parabola+pravougaonik, sračunava se iz izraza:

$$\alpha_b = \frac{\varepsilon_b}{12} \times (6 - \varepsilon_b) \qquad (\text{za } \varepsilon_b \le 2‰)$$

$$\alpha_b = \frac{3\varepsilon_b - 2}{3\varepsilon_b} \qquad (\text{za } 2‰ \le \varepsilon_b \le 3.5‰)$$





f_B - računska čvrstoća betona pri pritisku. U zavisnosti od marke betona, a za Pravilnikom definisani računski dijagram betona u obliku parabola+pravougaonik, uzima vrednosti iz tabele (*član 82. Pravilnika BAB 87*):

MB	15	20	25	30	35	40	45	50	55	60
f_B [MPa]	10.5	14	17.25	20.5	23	25.5	27.75	30	31.5	33

[1] U slučaju naprezanja u fazi velikog ekscentriciteta, neutralna linija se nalazi u preseku (x < d), odnosno u preseku postoji i pritisnuta i zategnuta zona. "Gornja" ivica betona je uvek pritisnuta, a "donja" armatura uvek zategnuta, pa se znaci (uobičajeno "+" za pritisak, a "–" za zatezanje) podrazumevaju i uglavnom izostavljaju, što je naravno matematički nekorektno. U slučaju kada su preseci napregnuti u fazi malog ekscentriciteta, odnosno kada naponi u preseku mogu biti istog znaka, o ovome se strogo vodi računa i znaci navode.

Z_{au} - sila zatezanja u armaturi, određena izrazom:

$$Z_{au} = A_{a1} \times \sigma_{a1} = A_{a1} \times \sigma_v$$

σ_v - karakteristična vrednost granice velikih izduženja (granice tečenja) za upotrebljenu vrstu čelika, uzima sledeće vrednosti:

σ_v = 240 MPa za GA 240/360 σ_v = 500 MPa za MA 500/560

σ_v = 400 MPa za RA 400/500

z - ***krak unutrašnjih sila*** – rastojanje između napadnih tačaka sile pritiska u betonu D_{bu} i sile zatezanja u armaturi Z_{au}. Sila D_{bu} deluje u težištu naponskog dijagrama pritiska, na rastojanju $\eta \times x$ od krajnje pritisnute ivice, dok sila Z_{au} deluje u težištu zategnute armature, pa sledi:

$$z = h - \eta \times x = h \times (1 - \eta \times s) = \zeta \times h$$

Koeficijent η, koji je dat u tabelama za dimenzionisanje, zavisi od oblika naponskog dijagrama betona i za računski dijagram u obliku parabola+pravougaonik, sračunava se iz izraza:

$$\eta = \frac{8 - \varepsilon_b}{4 \times (6 - \varepsilon_b)} \qquad (\text{za } \varepsilon_b \le 2‰)$$

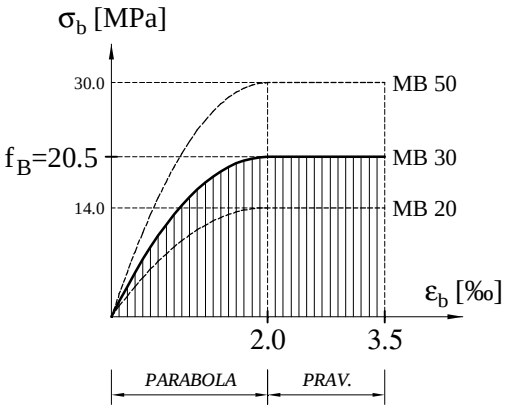
$$\eta = \frac{\varepsilon_b \times (3\varepsilon_b - 4) + 2}{2\varepsilon_b \times (3\varepsilon_b - 2)} \qquad (\text{za } 2‰ \le \varepsilon_b \le 3.5‰)$$

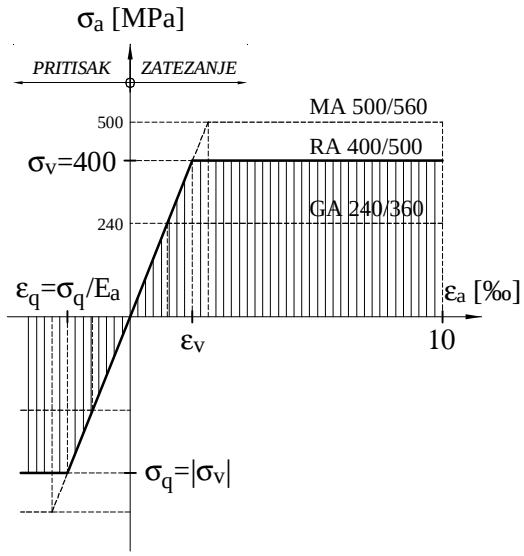
TABLICE ZA DIMENZIONISANJE PRAVOUGAONIH POPREČNIH PRESEKA NAPREGNUTIH NA SLOŽENO SAVIJANJE

$$\boxed{s = \frac{x}{h} = \frac{\varepsilon_b}{\varepsilon_b + \varepsilon_{a1}}}$$

$$\alpha_b = \frac{\varepsilon_b}{12} \times (6 - \varepsilon_b) \quad ; \qquad \eta = \frac{8 - \varepsilon_b}{4 \times (6 - \varepsilon_b)} \qquad (\text{za } \varepsilon_b \le 2‰)$$

$$\alpha_b = \frac{3\varepsilon_b - 2}{3\varepsilon_b} \quad ; \qquad \eta = \frac{\varepsilon_b \times (3\varepsilon_b - 4) + 2}{2\varepsilon_b \times (3\varepsilon_b - 2)} \qquad (\text{za } 2‰ \le \varepsilon_b \le 3.5‰)$$





MB	15	20	25	30	35	40	45	50	55	60
f_B	10.5	14	17.25	20.5	23	25.5	27.75	30	31.5	33

$$\zeta = \frac{z}{h} = 1 - \eta \times s \quad ; \qquad \bar{\mu}_1 = \mu_{1M} = \alpha_b \times s \quad ; \qquad k = \sqrt{\frac{1}{\alpha_b \times s \times \zeta}}$$

$$\boxed{k = \frac{h}{\sqrt{\frac{M_{au}}{b \times f_B}}}}$$

$$M_{au} = M_u + N_u \times y_{a1} = M_u + N_u \times (y_{b1} - a_1) = M_u + N_u \times \left(\frac{d}{2} - a_1\right)$$

$$\bar{\mu}_1 = \mu_{1M} = \alpha \times s = \frac{A_{a1}}{b \times h} \times \frac{\sigma_v}{f_B} = \mu_1 \times \frac{\sigma_v}{f_B}$$

$$\boxed{A_{a1} = \bar{\mu}_1 \times b \times h \times \frac{f_B}{\sigma_v} - \frac{N_u}{\sigma_v}} \quad \text{ili}$$

$$\boxed{A_{a1} = \frac{M_{au}}{z \times \sigma_v} - \frac{N_u}{\sigma_v} = \frac{M_{au}}{\zeta \times h \times \sigma_v} - \frac{N_u}{\sigma_v}}$$

Koeficijenti za proračun pravougaonih preseka opterećenih na pravo savijanje

LOM PO ARMATURI (ε_a = 10‰)

ε_b	s	α_b	η	ζ	μ_{1M} %	k
3.5	0.259	0.810	0.416	0.892	20.988	2.311
3.475	0.258	0.808	0.415	0.893	20.841	2.318
3.45	0.257	0.807	0.415	0.894	20.694	2.325
3.425	0.255	0.805	0.414	0.894	20.546	2.333
3.4	0.254	0.804	0.414	0.895	20.398	2.340
3.375	0.252	0.802	0.413	0.896	20.249	2.348
3.35	0.251	0.801	0.413	0.896	20.100	2.356
3.325	0.250	0.799	0.412	0.897	19.950	2.364
3.3	0.248	0.798	0.412	0.898	19.799	2.372
3.275	0.247	0.796	0.411	0.899	19.648	2.380
3.25	0.245	0.795	0.411	0.899	19.497	2.388
3.225	0.244	0.793	0.410	0.900	19.345	2.397
3.2	0.242	0.792	0.410	0.901	19.192	2.405
3.175	0.241	0.790	0.409	0.901	19.039	2.414
3.15	0.240	0.788	0.408	0.902	18.885	2.423
3.125	0.238	0.787	0.408	0.903	18.730	2.432
3.1	0.237	0.785	0.407	0.904	18.575	2.441
3.075	0.235	0.783	0.407	0.904	18.419	2.450
3.05	0.234	0.781	0.406	0.905	18.263	2.460
3.025	0.232	0.780	0.405	0.906	18.106	2.469
3	0.231	0.778	0.405	0.907	17.949	2.479
2.975	0.229	0.776	0.404	0.907	17.791	2.489
2.95	0.228	0.774	0.404	0.908	17.632	2.499
2.925	0.226	0.772	0.403	0.909	17.473	2.509
2.9	0.225	0.770	0.402	0.910	17.313	2.520
2.875	0.223	0.768	0.402	0.910	17.152	2.531
2.85	0.222	0.766	0.401	0.911	16.991	2.542
2.825	0.220	0.764	0.400	0.912	16.829	2.553
2.8	0.219	0.762	0.400	0.913	16.667	2.564
2.775	0.217	0.760	0.399	0.913	16.504	2.576
2.75	0.216	0.758	0.398	0.914	16.340	2.587
2.725	0.214	0.755	0.397	0.915	16.176	2.599
2.7	0.213	0.753	0.397	0.916	16.010	2.612
2.675	0.211	0.751	0.396	0.916	15.845	2.624
2.65	0.209	0.748	0.395	0.917	15.679	2.637

ε_b	s	α_b	η	ζ	μ_{1M} %	k
2.625	0.208	0.746	0.395	0.918	15.512	2.650
2.6	0.206	0.744	0.394	0.919	15.344	2.663
2.575	0.205	0.741	0.393	0.919	15.176	2.677
2.55	0.203	0.739	0.392	0.920	15.007	2.691
2.525	0.202	0.736	0.392	0.921	14.837	2.705
2.5	0.200	0.733	0.391	0.922	14.667	2.720
2.475	0.198	0.731	0.390	0.923	14.496	2.734
2.45	0.197	0.728	0.389	0.923	14.324	2.750
2.425	0.195	0.725	0.389	0.924	14.152	2.765
2.4	0.194	0.722	0.388	0.925	13.978	2.781
2.375	0.192	0.719	0.387	0.926	13.805	2.797
2.35	0.190	0.716	0.386	0.927	13.630	2.814
2.325	0.189	0.713	0.385	0.927	13.455	2.831
2.3	0.187	0.710	0.385	0.928	13.279	2.849
2.275	0.185	0.707	0.384	0.929	13.103	2.866
2.25	0.184	0.704	0.383	0.930	12.925	2.885
2.225	0.182	0.700	0.382	0.930	12.747	2.904
2.2	0.180	0.697	0.381	0.931	12.568	2.923
2.175	0.179	0.693	0.381	0.932	12.389	2.943
2.15	0.177	0.690	0.380	0.933	12.209	2.963
2.125	0.175	0.686	0.379	0.934	12.027	2.984
2.1	0.174	0.683	0.378	0.934	11.846	3.006
2.075	0.172	0.679	0.377	0.935	11.663	3.028
2.05	0.170	0.675	0.377	0.936	11.480	3.051
2.025	0.168	0.671	0.376	0.937	11.296	3.074
2	0.167	0.667	0.375	0.938	11.111	3.098
1.975	0.165	0.662	0.374	0.938	10.926	3.123
1.95	0.163	0.658	0.373	0.939	10.739	3.149
1.925	0.161	0.654	0.373	0.940	10.552	3.175
1.9	0.160	0.649	0.372	0.941	10.365	3.203
1.875	0.158	0.645	0.371	0.941	10.177	3.231
1.85	0.156	0.640	0.370	0.942	9.988	3.260
1.825	0.154	0.635	0.370	0.943	9.799	3.290
1.8	0.153	0.630	0.369	0.944	9.610	3.321
1.775	0.151	0.625	0.368	0.944	9.421	3.352

Koeficijenti za proračun pravougaonih preseka opterećenih na pravo savijanje

LOM PO ARMATURI (ε_a = 10‰)

ε_b	s	α_b	η	ζ	μ_{1M} %	k
1.75	0.149	0.620	0.368	0.945	9.231	3.385
1.725	0.147	0.615	0.367	0.946	9.041	3.419
1.7	0.145	0.609	0.366	0.947	8.851	3.454
1.675	0.143	0.604	0.366	0.948	8.661	3.491
1.65	0.142	0.598	0.365	0.948	8.471	3.528
1.625	0.140	0.592	0.364	0.949	8.282	3.567
1.6	0.138	0.587	0.364	0.950	8.092	3.607
1.575	0.136	0.581	0.363	0.951	7.903	3.648
1.55	0.134	0.575	0.362	0.951	7.714	3.691
1.525	0.132	0.569	0.362	0.952	7.525	3.736
1.5	0.130	0.563	0.361	0.953	7.337	3.782
1.475	0.129	0.556	0.360	0.954	7.149	3.830
1.45	0.127	0.550	0.360	0.954	6.962	3.879
1.425	0.125	0.543	0.359	0.955	6.776	3.931
1.4	0.123	0.537	0.359	0.956	6.591	3.984
1.375	0.121	0.530	0.358	0.957	6.406	4.039
1.35	0.119	0.523	0.358	0.957	6.222	4.097
1.325	0.117	0.516	0.357	0.958	6.039	4.157
1.3	0.115	0.509	0.356	0.959	5.858	4.219
1.275	0.113	0.502	0.356	0.960	5.677	4.284
1.25	0.111	0.495	0.355	0.961	5.498	4.352
1.225	0.109	0.487	0.355	0.961	5.320	4.422
1.2	0.107	0.480	0.354	0.962	5.143	4.496
1.175	0.105	0.472	0.354	0.963	4.968	4.573
1.15	0.103	0.465	0.353	0.964	4.794	4.653
1.125	0.101	0.457	0.353	0.964	4.622	4.737
1.1	0.099	0.449	0.352	0.965	4.451	4.825
1.075	0.097	0.441	0.352	0.966	4.283	4.917
1.05	0.095	0.433	0.351	0.967	4.116	5.014
1.025	0.093	0.425	0.351	0.967	3.951	5.115
1	0.091	0.417	0.350	0.968	3.788	5.222
0.975	0.089	0.408	0.350	0.969	3.627	5.334
0.95	0.087	0.400	0.349	0.970	3.469	5.453
0.925	0.085	0.391	0.349	0.970	3.312	5.578
0.9	0.083	0.383	0.348	0.971	3.158	5.710

ε_b	s	α_b	η	ζ	μ_{1M} %	k
0.875	0.080	0.374	0.348	0.972	3.007	5.849
0.85	0.078	0.365	0.347	0.973	2.858	5.997
0.825	0.076	0.356	0.347	0.974	2.711	6.155
0.8	0.074	0.347	0.346	0.974	2.568	6.322
0.775	0.072	0.337	0.346	0.975	2.427	6.500
0.75	0.070	0.328	0.345	0.976	2.289	6.690
0.725	0.068	0.319	0.345	0.977	2.154	6.894
0.7	0.065	0.309	0.344	0.977	2.023	7.112
0.675	0.063	0.300	0.344	0.978	1.894	7.347
0.65	0.061	0.290	0.343	0.979	1.769	7.599
0.625	0.059	0.280	0.343	0.980	1.647	7.872
0.6	0.057	0.270	0.343	0.981	1.528	8.169
0.575	0.054	0.260	0.342	0.981	1.413	8.491
0.55	0.052	0.250	0.342	0.982	1.302	8.842
0.525	0.050	0.240	0.341	0.983	1.195	9.227
0.5	0.048	0.229	0.341	0.984	1.091	9.651
0.475	0.045	0.219	0.340	0.985	0.992	10.120
0.45	0.043	0.208	0.340	0.985	0.896	10.641
0.425	0.041	0.197	0.340	0.986	0.805	11.224
0.4	0.038	0.187	0.339	0.987	0.718	11.880
0.375	0.036	0.176	0.339	0.988	0.635	12.623
0.35	0.034	0.165	0.338	0.989	0.557	13.473
0.325	0.031	0.154	0.338	0.989	0.484	14.454
0.3	0.029	0.143	0.338	0.990	0.415	15.599
0.275	0.027	0.131	0.337	0.991	0.351	16.952
0.25	0.024	0.120	0.337	0.992	0.292	18.577
0.225	0.022	0.108	0.337	0.993	0.238	20.563
0.2	0.020	0.097	0.336	0.993	0.190	23.045
0.175	0.017	0.085	0.336	0.994	0.146	26.238
0.15	0.015	0.073	0.335	0.995	0.108	30.495
0.125	0.012	0.061	0.335	0.996	0.076	36.456
0.1	0.010	0.049	0.335	0.997	0.049	45.399
0.075	0.007	0.037	0.334	0.998	0.028	60.304
0.05	0.005	0.025	0.334	0.998	0.012	90.117
0.025	0.002	0.012	0.334	0.999	0.003	179.558

Koeficijenti za proračun pravougaonih preseka opterećenih na pravo savijanje

LOM PO BETONU ($\varepsilon_b = 3.5‰$; $\alpha_b = 0.810$; $\eta = 0.416$)

ε_a	s	ζ	μ_{1M} %	k
10	0.259	0.892	20.988	2.311
9.95	0.260	0.892	21.066	2.307
9.9	0.261	0.891	21.144	2.303
9.85	0.262	0.891	21.223	2.300
9.8	0.263	0.891	21.303	2.296
9.75	0.264	0.890	21.384	2.292
9.7	0.265	0.890	21.465	2.288
9.65	0.266	0.889	21.546	2.285
9.6	0.267	0.889	21.628	2.281
9.55	0.268	0.888	21.711	2.277
9.5	0.269	0.888	21.795	2.273
9.45	0.270	0.888	21.879	2.269
9.4	0.271	0.887	21.964	2.265
9.35	0.272	0.887	22.049	2.262
9.3	0.273	0.886	22.135	2.258
9.25	0.275	0.886	22.222	2.254
9.2	0.276	0.885	22.310	2.250
9.15	0.277	0.885	22.398	2.246
9.1	0.278	0.884	22.487	2.242
9.05	0.279	0.884	22.576	2.238
9	0.280	0.884	22.667	2.235
8.95	0.281	0.883	22.758	2.231
8.9	0.282	0.883	22.849	2.227
8.85	0.283	0.882	22.942	2.223
8.8	0.285	0.882	23.035	2.219
8.75	0.286	0.881	23.129	2.215
8.7	0.287	0.881	23.224	2.211
8.65	0.288	0.880	23.320	2.207
8.6	0.289	0.880	23.416	2.203
8.55	0.290	0.879	23.513	2.199
8.5	0.292	0.879	23.611	2.195
8.45	0.293	0.878	23.710	2.192
8.4	0.294	0.878	23.810	2.188
8.35	0.295	0.877	23.910	2.184
8.3	0.297	0.877	24.011	2.180
8.25	0.298	0.876	24.113	2.176
8.2	0.299	0.876	24.217	2.172
8.15	0.300	0.875	24.320	2.168
8.1	0.302	0.874	24.425	2.164
8.05	0.303	0.874	24.531	2.160
8	0.304	0.873	24.638	2.156
7.95	0.306	0.873	24.745	2.152
7.9	0.307	0.872	24.854	2.148
7.85	0.308	0.872	24.963	2.144
7.8	0.310	0.871	25.074	2.140
7.75	0.311	0.871	25.185	2.136
7.7	0.313	0.870	25.298	2.132
7.65	0.314	0.869	25.411	2.128
7.6	0.315	0.869	25.526	2.123
7.55	0.317	0.868	25.641	2.119
7.5	0.318	0.868	25.758	2.115
7.45	0.320	0.867	25.875	2.111
7.4	0.321	0.866	25.994	2.107
7.35	0.323	0.866	26.114	2.103
7.3	0.324	0.865	26.235	2.099
7.25	0.326	0.865	26.357	2.095
7.2	0.327	0.864	26.480	2.091
7.15	0.329	0.863	26.604	2.087
7.1	0.330	0.863	26.730	2.083
7.05	0.332	0.862	26.856	2.078
7	0.333	0.861	26.984	2.074
6.95	0.335	0.861	27.113	2.070
6.9	0.337	0.860	27.244	2.066
6.85	0.338	0.859	27.375	2.062
6.8	0.340	0.859	27.508	2.058
6.75	0.341	0.858	27.642	2.053
6.7	0.343	0.857	27.778	2.049
6.65	0.345	0.857	27.915	2.045
6.6	0.347	0.856	28.053	2.041
6.55	0.348	0.855	28.192	2.037
6.5	0.350	0.854	28.333	2.032
6.45	0.352	0.854	28.476	2.028
6.4	0.354	0.853	28.620	2.024
6.35	0.355	0.852	28.765	2.020
6.3	0.357	0.851	28.912	2.016
6.25	0.359	0.851	29.060	2.011
6.2	0.361	0.850	29.210	2.007
6.15	0.363	0.849	29.361	2.003
6.1	0.365	0.848	29.514	1.998
6.05	0.366	0.848	29.668	1.994
6	0.368	0.847	29.825	1.990
5.95	0.370	0.846	29.982	1.986
5.9	0.372	0.845	30.142	1.981
5.85	0.374	0.844	30.303	1.977
5.8	0.376	0.843	30.466	1.973
5.75	0.378	0.843	30.631	1.968
5.7	0.380	0.842	30.797	1.964
5.65	0.383	0.841	30.965	1.960
5.6	0.385	0.840	31.136	1.955
5.55	0.387	0.839	31.308	1.951
5.5	0.389	0.838	31.481	1.947
5.45	0.391	0.837	31.657	1.942
5.4	0.393	0.836	31.835	1.938
5.35	0.395	0.835	32.015	1.934
5.3	0.398	0.835	32.197	1.929
5.25	0.400	0.834	32.381	1.925
5.2	0.402	0.833	32.567	1.920
5.15	0.405	0.832	32.755	1.916
5.1	0.407	0.831	32.946	1.912
5.05	0.409	0.830	33.138	1.907
5	0.412	0.829	33.333	1.903
4.95	0.414	0.828	33.531	1.898
4.9	0.417	0.827	33.730	1.894
4.85	0.419	0.826	33.932	1.889
4.8	0.422	0.825	34.137	1.885

Koeficijenti za proračun pravougaonih preseka opterećenih na pravo savijanje

LOM PO BETONU ($\varepsilon_b = 3.5‰$; $\alpha_b = 0.810$; $\eta = 0.416$)

ε_a	s	ζ	μ_{1M} %	k
4.75	0.424	0.824	34.343	1.880
4.7	0.427	0.822	34.553	1.876
4.65	0.429	0.821	34.765	1.871
4.6	0.432	0.820	34.979	1.867
4.55	0.435	0.819	35.197	1.862
4.5	0.438	0.818	35.417	1.858
4.45	0.440	0.817	35.639	1.853
4.4	0.443	0.816	35.865	1.849
4.35	0.446	0.815	36.093	1.844
4.3	0.449	0.813	36.325	1.840
4.25	0.452	0.812	36.559	1.835
4.2	0.455	0.811	36.797	1.831
4.15	0.458	0.810	37.037	1.826
4.1	0.461	0.808	37.281	1.822
4.05	0.464	0.807	37.528	1.817
4	0.467	0.806	37.778	1.812
3.95	0.470	0.805	38.031	1.808
3.9	0.473	0.803	38.288	1.803
3.85	0.476	0.802	38.549	1.799
3.8	0.479	0.801	38.813	1.794
3.75	0.483	0.799	39.080	1.789
3.7	0.486	0.798	39.352	1.785
3.65	0.490	0.796	39.627	1.780
3.6	0.493	0.795	39.906	1.775
3.55	0.496	0.793	40.189	1.771
3.5	0.500	0.792	40.476	1.766
3.45	0.504	0.791	40.767	1.762
3.4	0.507	0.789	41.063	1.757
3.35	0.511	0.787	41.363	1.752
3.3	0.515	0.786	41.667	1.748
3.25	0.519	0.784	41.975	1.743
3.2	0.522	0.783	42.289	1.738
3.15	0.526	0.781	42.607	1.733
3.1	0.530	0.779	42.929	1.729
3.05	0.534	0.778	43.257	1.724
3	0.538	0.776	43.590	1.719
2.95	0.543	0.774	43.928	1.715
2.9	0.547	0.773	44.271	1.710
2.85	0.551	0.771	44.619	1.705
2.8	0.556	0.769	44.974	1.701
2.75	0.560	0.767	45.333	1.696
2.7	0.565	0.765	45.699	1.691
2.65	0.569	0.763	46.070	1.686
2.6	0.574	0.761	46.448	1.682
2.55	0.579	0.759	46.832	1.677
2.5	0.583	0.757	47.222	1.672
2.45	0.588	0.755	47.619	1.667
2.4	0.593	0.753	48.023	1.663
2.35	0.598	0.751	48.433	1.658
2.3	0.603	0.749	48.851	1.653
2.25	0.609	0.747	49.275	1.648
2.2	0.614	0.745	49.708	1.644
2.15	0.619	0.742	50.147	1.639
2.1	0.625	0.740	50.595	1.634
2.05	0.631	0.738	51.051	1.630
2	0.636	0.735	51.515	1.625
1.95	0.642	0.733	51.988	1.620
1.9	0.648	0.730	52.469	1.615
1.85	0.654	0.728	52.960	1.611
1.8	0.660	0.725	53.459	1.606
1.75	0.667	0.723	53.968	1.601
1.7	0.673	0.720	54.487	1.597
1.65	0.680	0.717	55.016	1.592
1.6	0.686	0.715	55.556	1.587
1.55	0.693	0.712	56.106	1.583
1.5	0.700	0.709	56.667	1.578
1.45	0.707	0.706	57.239	1.573
1.4	0.714	0.703	57.823	1.569
1.35	0.722	0.700	58.419	1.564
1.3	0.729	0.697	59.028	1.559
1.25	0.737	0.693	59.649	1.555
1.2	0.745	0.690	60.284	1.550
1.15	0.753	0.687	60.932	1.546
1.1	0.761	0.684	61.594	1.541
1.05	0.769	0.680	62.271	1.537
1	0.778	0.676	62.963	1.532
0.95	0.787	0.673	63.670	1.528
0.9	0.795	0.669	64.394	1.523
0.85	0.805	0.665	65.134	1.519
0.8	0.814	0.661	65.891	1.515
0.75	0.824	0.657	66.667	1.510
0.7	0.833	0.653	67.460	1.506
0.65	0.843	0.649	68.273	1.502
0.6	0.854	0.645	69.106	1.498
0.55	0.864	0.641	69.959	1.494
0.5	0.875	0.636	70.833	1.490
0.45	0.886	0.631	71.730	1.486
0.4	0.897	0.627	72.650	1.482
0.35	0.909	0.622	73.593	1.478
0.3	0.921	0.617	74.561	1.475
0.25	0.933	0.612	75.556	1.471
0.2	0.946	0.607	76.577	1.467
0.15	0.959	0.601	77.626	1.464
0.1	0.972	0.596	78.704	1.461
0.05	0.986	0.590	79.812	1.457
0	1.000	0.584	80.952	1.454
-0.05	1.014	0.578	82.126	1.451
-0.1	1.029	0.572	83.333	1.449
-0.15	1.045	0.565	84.577	1.446
-0.2	1.061	0.559	85.859	1.444
-0.25	1.077	0.552	87.179	1.441
-0.3	1.094	0.545	88.542	1.440
-0.35	1.111	0.538	89.947	1.438
-0.4	1.129	0.530	91.398	1.436
-0.45	1.148	0.523	92.896	1.435