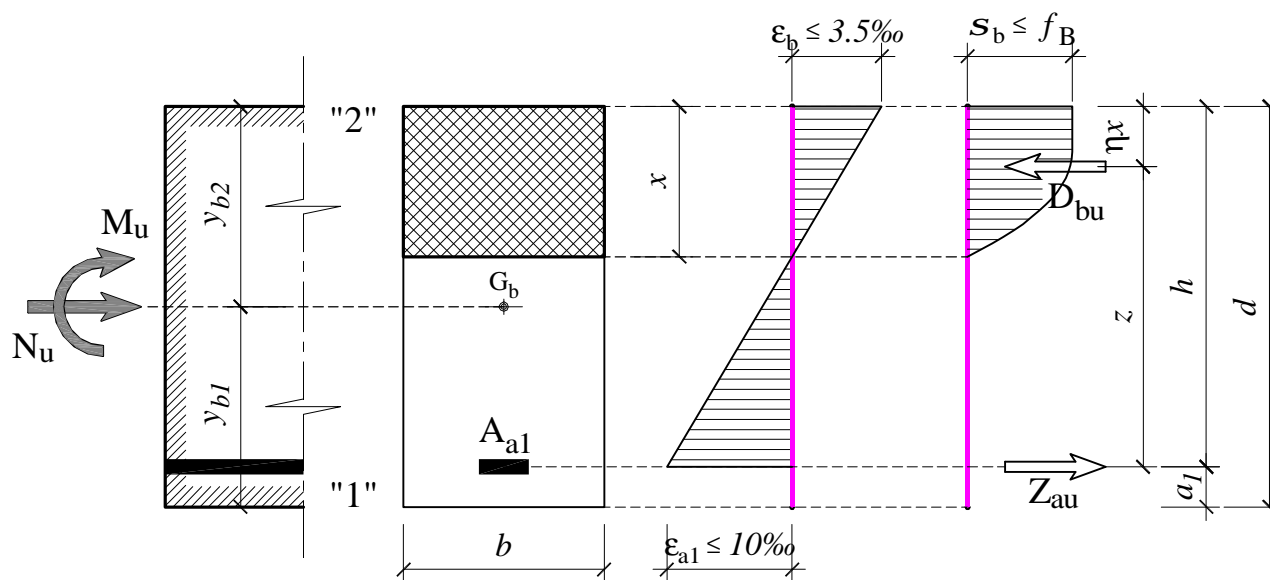# DIMENZIONISANJE PRAVOUGAONIH POPREČNIH PRESEKA NAPREGNUTIH NA PRAVO SLOŽENO SAVIJANJE

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:

$$\frac{x}{h-x} = \frac{\varepsilon_b}{\varepsilon_{a1}} \implies s = \frac{x}{h} = \frac{\varepsilon_b}{\varepsilon_b + \varepsilon_{a1}} = \frac{1}{1 + \dfrac{\varepsilon_{a1}}{\varepsilon_b}}$$
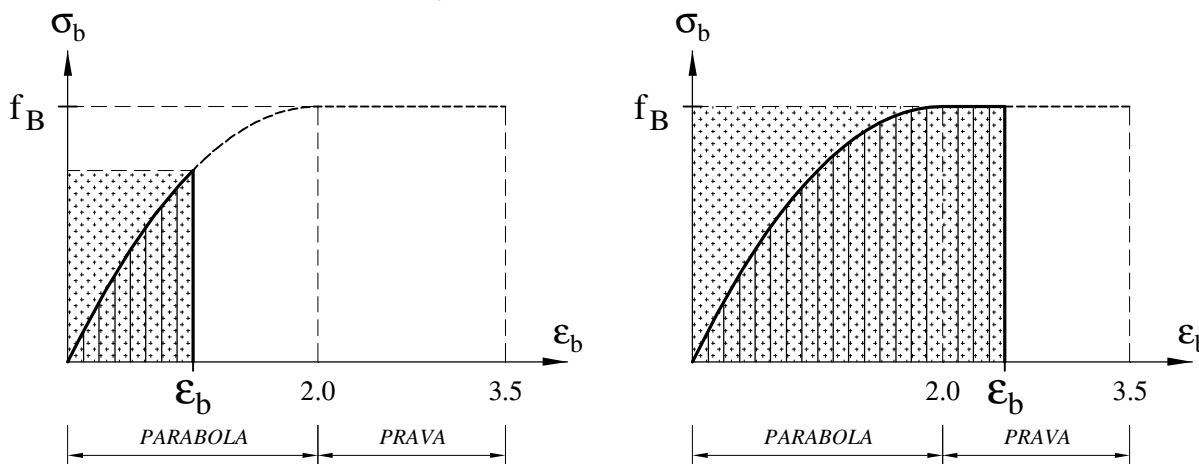
D_{bu} -   sila pritiska u betonu, određena izrazom:

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

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:

$\sigma_v = 240$ MPa za GA 240/360 $\sigma_v = 500$ MPa za MA 500/560

$\sigma_v = 400$ 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:

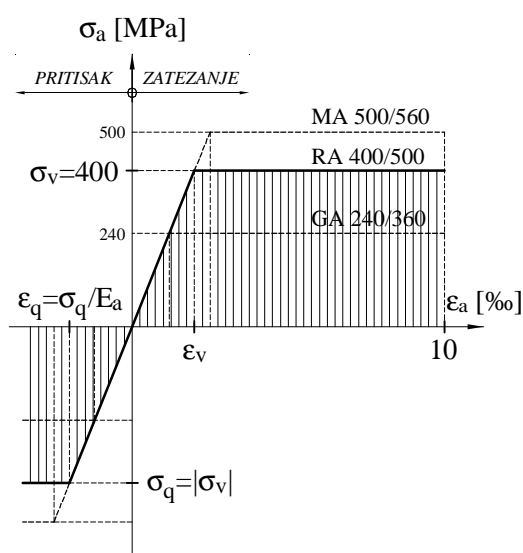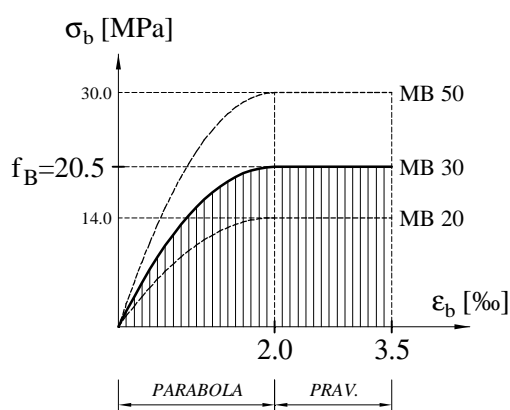$$\eta = \frac{8 - \varepsilon_b}{4 \times (6 - \varepsilon_b)} \qquad \text{(za } \varepsilon_b \le 2\text{‰)}$$

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

TABLICE ZA DIMENZIONISANJE PRAVOUGAONIH POPREČNIH PRESEKA NAPREGNUTIH NA SLOŽENO SAVIJANJE

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

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

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

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

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

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

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

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

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

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

Koeficijenti za proračun pravougaonih preseka opterećenih na pravo savijanje

LOM PO ARMATURI ($\varepsilon_a = 10‰$)

ε_b	s	α_b	η	ζ	μ_{1M} %	k	ε_b	s	α_b	η	ζ	μ_{1M} %	k
3.5	0.259	0.810	0.416	0.892	20.988	2.311	2.625	0.208	0.746	0.395	0.918	15.512	2.650
3.475	0.258	0.808	0.415	0.893	20.841	2.318	2.6	0.206	0.744	0.394	0.919	15.344	2.663
3.45	0.257	0.807	0.415	0.894	20.694	2.325	2.575	0.205	0.741	0.393	0.919	15.176	2.677
3.425	0.255	0.805	0.414	0.894	20.546	2.333	2.55	0.203	0.739	0.392	0.920	15.007	2.691
3.4	0.254	0.804	0.414	0.895	20.398	2.340	2.525	0.202	0.736	0.392	0.921	14.837	2.705
3.375	0.252	0.802	0.413	0.896	20.249	2.348	2.5	0.200	0.733	0.391	0.922	14.667	2.720
3.35	0.251	0.801	0.413	0.896	20.100	2.356	2.475	0.198	0.731	0.390	0.923	14.496	2.734
3.325	0.250	0.799	0.412	0.897	19.950	2.364	2.45	0.197	0.728	0.389	0.923	14.324	2.750
3.3	0.248	0.798	0.412	0.898	19.799	2.372	2.425	0.195	0.725	0.389	0.924	14.152	2.765
3.275	0.247	0.796	0.411	0.899	19.648	2.380	2.4	0.194	0.722	0.388	0.925	13.978	2.781
3.25	0.245	0.795	0.411	0.899	19.497	2.388	2.375	0.192	0.719	0.387	0.926	13.805	2.797
3.225	0.244	0.793	0.410	0.900	19.345	2.397	2.35	0.190	0.716	0.386	0.927	13.630	2.814
3.2	0.242	0.792	0.410	0.901	19.192	2.405	2.325	0.189	0.713	0.385	0.927	13.455	2.831
3.175	0.241	0.790	0.409	0.901	19.039	2.414	2.3	0.187	0.710	0.385	0.928	13.279	2.849
3.15	0.240	0.788	0.408	0.902	18.885	2.423	2.275	0.185	0.707	0.384	0.929	13.103	2.866
3.125	0.238	0.787	0.408	0.903	18.730	2.432	2.25	0.184	0.704	0.383	0.930	12.925	2.885
3.1	0.237	0.785	0.407	0.904	18.575	2.441	2.225	0.182	0.700	0.382	0.930	12.747	2.904
3.075	0.235	0.783	0.407	0.904	18.419	2.450	2.2	0.180	0.697	0.381	0.931	12.568	2.923
3.05	0.234	0.781	0.406	0.905	18.263	2.460	2.175	0.179	0.693	0.381	0.932	12.389	2.943
3.025	0.232	0.780	0.405	0.906	18.106	2.469	2.15	0.177	0.690	0.380	0.933	12.209	2.963
3	0.231	0.778	0.405	0.907	17.949	2.479	2.125	0.175	0.686	0.379	0.934	12.027	2.984
2.975	0.229	0.776	0.404	0.907	17.791	2.489	2.1	0.174	0.683	0.378	0.934	11.846	3.006
2.95	0.228	0.774	0.404	0.908	17.632	2.499	2.075	0.172	0.679	0.377	0.935	11.663	3.028
2.925	0.226	0.772	0.403	0.909	17.473	2.509	2.05	0.170	0.675	0.377	0.936	11.480	3.051
2.9	0.225	0.770	0.402	0.910	17.313	2.520	2.025	0.168	0.671	0.376	0.937	11.296	3.074
2.875	0.223	0.768	0.402	0.910	17.152	2.531	2	0.167	0.667	0.375	0.938	11.111	3.098
2.85	0.222	0.766	0.401	0.911	16.991	2.542	1.975	0.165	0.662	0.374	0.938	10.926	3.123
2.825	0.220	0.764	0.400	0.912	16.829	2.553	1.95	0.163	0.658	0.373	0.939	10.739	3.149
2.8	0.219	0.762	0.400	0.913	16.667	2.564	1.925	0.161	0.654	0.373	0.940	10.552	3.175
2.775	0.217	0.760	0.399	0.913	16.504	2.576	1.9	0.160	0.649	0.372	0.941	10.365	3.203
2.75	0.216	0.758	0.398	0.914	16.340	2.587	1.875	0.158	0.645	0.371	0.941	10.177	3.231
2.725	0.214	0.755	0.397	0.915	16.176	2.599	1.85	0.156	0.640	0.370	0.942	9.988	3.260
2.7	0.213	0.753	0.397	0.916	16.010	2.612	1.825	0.154	0.635	0.370	0.943	9.799	3.290
2.675	0.211	0.751	0.396	0.916	15.845	2.624	1.8	0.153	0.630	0.369	0.944	9.610	3.321
2.65	0.209	0.748	0.395	0.917	15.679	2.637	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 $(\varepsilon_a = 10‰)$

ε_b	s	α_b	η	ζ	μ_{1M} %	k	ε_b	s	α_b	η	ζ	μ_{1M} %	k
1.75	0.149	0.620	0.368	0.945	9.231	3.385	0.875	0.080	0.374	0.348	0.972	3.007	5.849
1.725	0.147	0.615	0.367	0.946	9.041	3.419	0.85	0.078	0.365	0.347	0.973	2.858	5.997
1.7	0.145	0.609	0.366	0.947	8.851	3.454	0.825	0.076	0.356	0.347	0.974	2.711	6.155
1.675	0.143	0.604	0.366	0.948	8.661	3.491	0.8	0.074	0.347	0.346	0.974	2.568	6.322
1.65	0.142	0.598	0.365	0.948	8.471	3.528	0.775	0.072	0.337	0.346	0.975	2.427	6.500
1.625	0.140	0.592	0.364	0.949	8.282	3.567	0.75	0.070	0.328	0.345	0.976	2.289	6.690
1.6	0.138	0.587	0.364	0.950	8.092	3.607	0.725	0.068	0.319	0.345	0.977	2.154	6.894
1.575	0.136	0.581	0.363	0.951	7.903	3.648	0.7	0.065	0.309	0.344	0.977	2.023	7.112
1.55	0.134	0.575	0.362	0.951	7.714	3.691	0.675	0.063	0.300	0.344	0.978	1.894	7.347
1.525	0.132	0.569	0.362	0.952	7.525	3.736	0.65	0.061	0.290	0.343	0.979	1.769	7.599
1.5	0.130	0.563	0.361	0.953	7.337	3.782	0.625	0.059	0.280	0.343	0.980	1.647	7.872
1.475	0.129	0.556	0.360	0.954	7.149	3.830	0.6	0.057	0.270	0.343	0.981	1.528	8.169
1.45	0.127	0.550	0.360	0.954	6.962	3.879	0.575	0.054	0.260	0.342	0.981	1.413	8.491
1.425	0.125	0.543	0.359	0.955	6.776	3.931	0.55	0.052	0.250	0.342	0.982	1.302	8.842
1.4	0.123	0.537	0.359	0.956	6.591	3.984	0.525	0.050	0.240	0.341	0.983	1.195	9.227
1.375	0.121	0.530	0.358	0.957	6.406	4.039	0.5	0.048	0.229	0.341	0.984	1.091	9.651
1.35	0.119	0.523	0.358	0.957	6.222	4.097	0.475	0.045	0.219	0.340	0.985	0.992	10.120
1.325	0.117	0.516	0.357	0.958	6.039	4.157	0.45	0.043	0.208	0.340	0.985	0.896	10.641
1.3	0.115	0.509	0.356	0.959	5.858	4.219	0.425	0.041	0.197	0.340	0.986	0.805	11.224
1.275	0.113	0.502	0.356	0.960	5.677	4.284	0.4	0.038	0.187	0.339	0.987	0.718	11.880
1.25	0.111	0.495	0.355	0.961	5.498	4.352	0.375	0.036	0.176	0.339	0.988	0.635	12.623
1.225	0.109	0.487	0.355	0.961	5.320	4.422	0.35	0.034	0.165	0.338	0.989	0.557	13.473
1.2	0.107	0.480	0.354	0.962	5.143	4.496	0.325	0.031	0.154	0.338	0.989	0.484	14.454
1.175	0.105	0.472	0.354	0.963	4.968	4.573	0.3	0.029	0.143	0.338	0.990	0.415	15.599
1.15	0.103	0.465	0.353	0.964	4.794	4.653	0.275	0.027	0.131	0.337	0.991	0.351	16.952
1.125	0.101	0.457	0.353	0.964	4.622	4.737	0.25	0.024	0.120	0.337	0.992	0.292	18.577
1.1	0.099	0.449	0.352	0.965	4.451	4.825	0.225	0.022	0.108	0.337	0.993	0.238	20.563
1.075	0.097	0.441	0.352	0.966	4.283	4.917	0.2	0.020	0.097	0.336	0.993	0.190	23.045
1.05	0.095	0.433	0.351	0.967	4.116	5.014	0.175	0.017	0.085	0.336	0.994	0.146	26.238
1.025	0.093	0.425	0.351	0.967	3.951	5.115	0.15	0.015	0.073	0.335	0.995	0.108	30.495
1	0.091	0.417	0.350	0.968	3.788	5.222	0.125	0.012	0.061	0.335	0.996	0.076	36.456
0.975	0.089	0.408	0.350	0.969	3.627	5.334	0.1	0.010	0.049	0.335	0.997	0.049	45.399
0.95	0.087	0.400	0.349	0.970	3.469	5.453	0.075	0.007	0.037	0.334	0.998	0.028	60.304
0.925	0.085	0.391	0.349	0.970	3.312	5.578	0.05	0.005	0.025	0.334	0.998	0.012	90.117
0.9	0.083	0.383	0.348	0.971	3.158	5.710	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	ε_a	s	ζ	μ_{1M} %	k	ε_a	s	ζ	μ_{1M} %	k
10	0.259	0.892	20.988	2.311	8.25	0.298	0.876	24.113	2.176	6.5	0.350	0.854	28.333	2.032
9.95	0.260	0.892	21.066	2.307	8.2	0.299	0.876	24.217	2.172	6.45	0.352	0.854	28.476	2.028
9.9	0.261	0.891	21.144	2.303	8.15	0.300	0.875	24.320	2.168	6.4	0.354	0.853	28.620	2.024
9.85	0.262	0.891	21.223	2.300	8.1	0.302	0.874	24.425	2.164	6.35	0.355	0.852	28.765	2.020
9.8	0.263	0.891	21.303	2.296	8.05	0.303	0.874	24.531	2.160	6.3	0.357	0.851	28.912	2.016
9.75	0.264	0.890	21.384	2.292	8	0.304	0.873	24.638	2.156	6.25	0.359	0.851	29.060	2.011
9.7	0.265	0.890	21.465	2.288	7.95	0.306	0.873	24.745	2.152	6.2	0.361	0.850	29.210	2.007
9.65	0.266	0.889	21.546	2.285	7.9	0.307	0.872	24.854	2.148	6.15	0.363	0.849	29.361	2.003
9.6	0.267	0.889	21.628	2.281	7.85	0.308	0.872	24.963	2.144	6.1	0.365	0.848	29.514	1.998
9.55	0.268	0.888	21.711	2.277	7.8	0.310	0.871	25.074	2.140	6.05	0.366	0.848	29.668	1.994
9.5	0.269	0.888	21.795	2.273	7.75	0.311	0.871	25.185	2.136	6	0.368	0.847	29.825	1.990
9.45	0.270	0.888	21.879	2.269	7.7	0.313	0.870	25.298	2.132	5.95	0.370	0.846	29.982	1.986
9.4	0.271	0.887	21.964	2.265	7.65	0.314	0.869	25.411	2.128	5.9	0.372	0.845	30.142	1.981
9.35	0.272	0.887	22.049	2.262	7.6	0.315	0.869	25.526	2.123	5.85	0.374	0.844	30.303	1.977
9.3	0.273	0.886	22.135	2.258	7.55	0.317	0.868	25.641	2.119	5.8	0.376	0.843	30.466	1.973
9.25	0.275	0.886	22.222	2.254	7.5	0.318	0.868	25.758	2.115	5.75	0.378	0.843	30.631	1.968
9.2	0.276	0.885	22.310	2.250	7.45	0.320	0.867	25.875	2.111	5.7	0.380	0.842	30.797	1.964
9.15	0.277	0.885	22.398	2.246	7.4	0.321	0.866	25.994	2.107	5.65	0.383	0.841	30.965	1.960
9.1	0.278	0.884	22.487	2.242	7.35	0.323	0.866	26.114	2.103	5.6	0.385	0.840	31.136	1.955
9.05	0.279	0.884	22.576	2.238	7.3	0.324	0.865	26.235	2.099	5.55	0.387	0.839	31.308	1.951
9	0.280	0.884	22.667	2.235	7.25	0.326	0.865	26.357	2.095	5.5	0.389	0.838	31.481	1.947
8.95	0.281	0.883	22.758	2.231	7.2	0.327	0.864	26.480	2.091	5.45	0.391	0.837	31.657	1.942
8.9	0.282	0.883	22.849	2.227	7.15	0.329	0.863	26.604	2.087	5.4	0.393	0.836	31.835	1.938
8.85	0.283	0.882	22.942	2.223	7.1	0.330	0.863	26.730	2.083	5.35	0.395	0.835	32.015	1.934
8.8	0.285	0.882	23.035	2.219	7.05	0.332	0.862	26.856	2.078	5.3	0.398	0.835	32.197	1.929
8.75	0.286	0.881	23.129	2.215	7	0.333	0.861	26.984	2.074	5.25	0.400	0.834	32.381	1.925
8.7	0.287	0.881	23.224	2.211	6.95	0.335	0.861	27.113	2.070	5.2	0.402	0.833	32.567	1.920
8.65	0.288	0.880	23.320	2.207	6.9	0.337	0.860	27.244	2.066	5.15	0.405	0.832	32.755	1.916
8.6	0.289	0.880	23.416	2.203	6.85	0.338	0.859	27.375	2.062	5.1	0.407	0.831	32.946	1.912
8.55	0.290	0.879	23.513	2.199	6.8	0.340	0.859	27.508	2.058	5.05	0.409	0.830	33.138	1.907
8.5	0.292	0.879	23.611	2.195	6.75	0.341	0.858	27.642	2.053	5	0.412	0.829	33.333	1.903
8.45	0.293	0.878	23.710	2.192	6.7	0.343	0.857	27.778	2.049	4.95	0.414	0.828	33.531	1.898
8.4	0.294	0.878	23.810	2.188	6.65	0.345	0.857	27.915	2.045	4.9	0.417	0.827	33.730	1.894
8.35	0.295	0.877	23.910	2.184	6.6	0.347	0.856	28.053	2.041	4.85	0.419	0.826	33.932	1.889
8.3	0.297	0.877	24.011	2.180	6.55	0.348	0.855	28.192	2.037	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