STEEL BARS *for* GENERAL STRUCTURAL PURPOSES

STEEL BARS FOR GENERAL STRUCTURAL PURPOSES

FLAT BAR

Metric units

Section Size		Unit Weight	Section Area
Thickness	Width	M	A
mm	mm	kg/ m	cm²
3.0	12.0	0.283	0.36
3.0	16.0	0.377	0.48
3.0	19.0	0.447	0.57
3.0	25.0	0.589	0.75
3.0	32.0	0.754	0.96
3.0	38.0	0.895	0.14
3.0	50.0	1.178	1.50
4.5	12.0	0.424	0.54
4.5	16.0	0.565	0.72
4.5	19.0	0.671	0.85
4.5	25.0	0.883	1.125
4.5	32.0	1.134	1.44
4.5	38.0	1.342	1.71
4.5	44.0	1.554	1.98
4.5	50.0	1.766	2.25
4.5	65.0	2.296	2.93
4.5	75.0	2.649	3.37
4.5	100.0	3.553	4.5
5.0	25.0	0.981	1.25
5.0	50.0	1.963	2.50
6.0	12.0	0.565	0.72
6.0	16.0	0.754	0.96
6.0	19.0	0.895	1.14
6.0	25.0	1.178	1.50
6.0	32.0	1.507	1.92
6.0	38.0	1.780	2.28
6.0	44.0	2.072	2.64
6.0	50.0	2.355	3.00
6.0	65.0	3.062	3.90
6.0	75.0	3.533	4.50
6.0	90.0	4.239	5.40
6.0	100.0	4.710	6.00
6.0	125.0	5.888	7.50
6.0	150.0	7.065	9.00
6.0	200.0	9.420	12.00
6.0	250.0	11.775	15.00
6.0	300.0	14.130	18.00
9.0	19.0	1.342	1.71
9.0	25.0	1.766	2.25
9.0	32.0	2.261	2.88
9.0	35.0	2.473	3.15
9.0	38.0	2.685	3.42
9.0	44.0	3.109	3.96
9.0	50.0	3.533	4.50
9.0	65.0	4.592	5.85
9.0	75.0	5.299	6.75
9.0	90.0	6.359	8.10
9.0	100.0	7.065	10.00
9.0	125.0	8.831	11.25
9.0	150.0	10.590	13.50
9.0	180.0	12.717	16.20
9.0	200.0	14.130	18.00
9.0	230.0	16.250	20.70
9.0	250.0	17.663	22.50
9.0	300.0	21.195	27.00
12.0	25.0	2.355	3.00
12.0	32.0	3.014	3.84
12.0	35.0	3.297	4.20
12.0	38.0	3.580	4.56
12.0	44.0	4.145	5.28
12.0	50.0	4.710	6.00
12.0	65.0	6.123	7.80
12.0	75.0	7.065	9.00
12.0	90.0	8.478	10.80
12.0	100.0	9.420	12.00
12.0	125.0	11.775	15.00
12.0	150.0	14.130	18.00
12.0	180.0	16.956	21.60
12.0	200.0	18.840	24.00
12.0	230.0	21.666	27.60
12.0	250.0	23.550	30.00
12.0	280.0	26.576	33.60
12.0	300.0	28.260	36.00

Section Size		Unit Weight	Section Area
Thickness	Width	M	A
mm	mm	kg/ m	cm²
16.0	25.0	3.140	4.00
16.0	32.0	4.192	5.12
16.0	38.0	4.773	6.08
16.0	44.0	5.526	7.04
16.0	50.0	6.280	8.00
16.0	65.0	8.164	10.40
16.0	75.0	9.420	12.00
16.0	90.0	11.304	14.40
16.0	100.0	12.560	16.00
16.0	125.0	15.700	20.00
16.0	150.0	18.840	24.00
16.0	180.0	22.608	28.00
16.0	200.0	25.120	32.00
16.0	230.0	28.880	36.80
16.0	250.0	31.400	50.00
16.0	280.0	35.168	44.80
16.0	300.0	37.680	48.00
18.0	50.0	7.065	9.00
18.0	75.0	10.590	13.50
18.0	100.0	14.130	18.00
18.0	125.0	18.663	22.50
18.0	150.0	21.195	27.00
18.0	200.0	28.260	36.00
18.0	225.0	31.793	40.50
18.0	250.0	35.325	45.00
18.0	275.0	38.850	49.50
18.0	300.0	42.390	54.00
19.0	38.0	5.668	7.22
19.0	44.0	6.563	8.36
19.0	50.0	7.458	9.50
19.0	65.0	9.695	12.35
19.0	75.0	11.186	14.25
19.0	90.0	13.424	17.10
19.0	100.0	14.915	19.00
19.0	125.0	18.644	23.75
19.0	150.0	22.373	28.50
19.0	180.0	26.847	34.20
19.0	200.0	29.830	38.00
19.0	230.0	34.305	43.70
19.0	250.0	37.288	47.50
19.0	280.0	41.762	53.20
19.0	300.0	44.745	57.00
22.0	50.0	8.635	11.00
22.0	65.0	11.226	14.30
22.0	75.0	12.953	16.50
22.0	90.0	15.543	19.80
22.0	100.0	17.270	22.00
22.0	125.0	21.588	27.50
22.0	150.0	25.905	33.00
22.0	180.0	31.086	39.60
22.0	200.0	34.540	44.00
22.0	230.0	39.721	50.60
22.0	250.0	43.175	55.00
22.0	280.0	48.356	61.00
22.0	300.0	51.810	66.00
25.0	50.0	9.813	12.50
25.0	65.0	12.756	16.25
25.0	75.0	14.719	18.75
25.0	90.0	17.663	22.50
25.0	100.0	19.625	25.00
25.0	125.0	24.531	31.25
25.0	150.0	29.438	37.50
25.0	180.0	35.325	45.00
25.0	200.0	39.250	50.00
25.0	230.0	45.138	57.50
25.0	250.0	49.063	62.50
25.0	280.0	54.950	70.00
25.0	300.0	58.875	75.00s

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STEEL BARS DIMENSIONAL INFORMATION

ROUND BAR

Size	Diameter		Weight			Sectional Area		Moment of Inertial I	Radius of Gyration i	Modulus of Section S
	mm	in	kg/m	kg/ft	lb/ft	cm^2	in^2	in^4	in	in^3
6	6	0.236	0.222	0.0667	0.149	0.2827	.04382	0.0002	0.0591	0.0012
7	7	0.276	0.302	0.0921	0.203	0.3848	.05964	0.0002	0.0709	0.0018
8	8	0.315	0.395	0.120	0.265	0.5027	.07792	0.0005	0.0787	0.0031
9	9	0.354	0.499	0.152	0.335	0.6362	.09861	0.0007	0.0906	0.0043
10	10	0.394	0.617	0.188	0.415	0.7854	0.1217	0.0012	0.0984	0.0061
11	11	0.433	0.746	0.227	0.501	0.9503	0.1473	0.0017	0.110	0.0079
12	12	0.472	0.888	0.271	0.597	1.131	0.1753	0.0024	0.118	0.0104
13	13	0.512	1.042	0.318	0.700	1.327	0.2057	0.0034	0.130	0.0134
14	14	0.551	1.208	0.368	0.812	1.539	0.2385	0.0046	0.138	0.0165
15	15	0.591	1.387	0.423	0.932	1.767	0.2739	0.0060	0.150	0.0201
16	16	0.630	1.578	0.481	1.060	2.011	0.3117	0.0077	0.157	0.0244
17	17	0.669	1.782	0.543	1.197	2.270	0.3519	0.0099	0.169	0.0293
18	18	0.709	1.998	0.609	1.343	2.545	0.3945	0.0125	0.177	0.0348
19	19	0.748	2.226	0.678	1.496	2.835	0.4394	0.0154	0.189	0.0409
20	20	0.787	2.466	0.752	1.657	3.142	0.4870	0.0190	0.197	0.0482
21	21	0.827	2.719	0.829	1.827	3.464	0.5369	0.0228	0.209	0.0555
22	22	0.866	2.984	0.910	2.005	3.801	0.5892	0.0276	0.217	0.0641
23	23	0.906	3.261	0.994	2.191	4.155	0.6440	0.0329	0.228	0.0726
24	24	0.945	3.551	1.082	2.386	4.524	0.7012	0.0392	0.236	0.0830
25	25	0.984	3.853	1.174	2.589	4.909	0.7609	0.0461	0.248	0.0934
26	26	1.024	4.168	1.270	2.801	5.309	0.8229	0.0538	0.256	0.106
27	27	1.063	4.494	1.370	3.020	5.726	0.8875	0.0627	0.268	0.118
28	28	1.102	4.833	1.473	3.247	6.158	0.9545	0.0726	0.276	0.132
29	29	1.142	5.185	1.580	3.484	6.605	1.024	0.0834	0.287	0.146
30	30	1.181	5.549	1.691	3.729	7.069	1.096	0.0956	0.295	0.162
31	31	1.220	5.925	1.806	3.981	7.548	1.170	0.1090	0.307	0.179
32	32	1.260	6.313	1.924	4.242	8.042	1.247	0.124	0.315	0.196
34	34	1.339	7.127	2.172	4.790	9.079	1.407	0.158	0.335	0.236
35	35	1.378	7.552	2.302	5.074	9.621	1.491	0.177	0.346	0.257
36	36	1.417	7.990	2.435	5.369	10.18	1.578	0.198	0.354	0.279
38	38	1.496	8.902	2.713	5.982	11.34	1.758	0.245	0.374	0.329
40	40	1.575	9.864	3.006	6.628	12.57	1.948	0.303	0.394	0.383
42	42	1.654	10.875	3.315	7.307	13.85	2.147	0.368	0.413	0.444
44	44	1.732	11.936	3.638	8.020	15.21	2.358	0.442	0.433	0.510
46	46	1.811	13.045	3.976	8.765	16.62	2.576	0.529	0.453	0.583
48	48	1.890	14.204	4.329	9.544	18.10	2.805	0.627	0.472	0.665
50	50	1.969	15.413	4.698	10.356	19.63	3.043	0.738	0.492	0.751
55	55	2.165	18.650	5.684	12.531	23.76	3.683	1.079	0.543	0.995
60	60	2.362	22.195	6.759	14.913	28.27	4.382	1.528	0.591	1.294
65	65	2.559	26.048	7.939	17.502	33.18	5.143	2.105	0.642	1.648
70	70	2.756	30.209	9.207	20.297	38.48	5.964	2.835	0.689	2.056
75	75	2.953	34.679	10.570	23.301	44.18	6.848	3.724	0.740	2.526
80	80	3.150	39.457	12.026	26.511	50.27	7.792	4.829	0.787	3.069
85	85	3.346	44.543	13.576	29.928	56.75	8.796	6.150	0.839	3.680
90	90	3.543	49.938	15.220	33.553	63.62	9.861	7.736	0.886	4.369
95	95	3.740	55.640	16.958	37.385	70.88	10.99	9.610	0.937	5.138
100	100	3.937	61.651	18.790	41.423	78.54	12.17	11.795	0.984	5.992
105	105	4.134	67.971	20.717	45.670	86.59	13.42	14.342	1.035	6.957
110	110	4.331	74.598	22.736	50.122	95.03	14.73	17.273	1.083	7.994
115	115	4.528	81.534	24.850	54.785	103.9	16.10	20.637	1.134	9.092
120	120	4.724	88.778	27.058	59.653	113.1	17.53	24.504	1.181	10.374
125	125	4.921	96.330	29.360	64.727	122.7	19.02	28.829	1.232	11.716
130	130	5.118	104.191	31.756	70.009	132.7	20.57	33.634	1.280	13.181
135	135	5.315	112.360	34.246	75.498	143.1	22.18	39.159	1.331	14.768
140	140	5.512	120.837	36.829	80.873	153.9	23.85	45.405	1.378	16.415
145	145	5.709	129.622	39.507	87.097	165.1	25.59	52.132	1.429	18.246
150	150	5.906	138.716	42.279	93.207	176.7	27.39	59.820	1.476	20.199
160	160	6.299	157.828	48.104	106.049	201.1	31.17	77.357	1.575	24.531
170	170	6.693	178.173	54.304	119.720	227.0	35.19	98.498	1.673	29.431
180	180	7.087	199.751	60.881	134.219	254.5	39.45	123.72	1.772	34.966
190	190	7.480	222.562	67.834	149.546	283.5	43.94	153.75	1.870	41.068
200	200	7.874	246.606	75.162	165.702	314.2	48.70	188.59	1.969	47.903

STEEL BARS FOR GENERAL STRUCTURAL PURPOSES

SQUARE BAR

Metric units

Section Size	Unit Weight M		Side Length A		Section Area A		Moment of Inertia	Radius of Gyration	Modulus of Section
mm	kg/m	lb/ft	mm	in	cm^2	in^2	in^4	in	in^3
9	0.636	0.427	9	0.354	0.81	0.1260	-	-	-
10	0.785	0.527	10	0.393	1.00	0.1549	-	-	-
12	1.130	0.759	12	0.470	1.44	0.2231	-	-	-
16	2.010	1.351	16	0.630	2.56	0.3968	0.0132	0.181	0.0415
18	2.543	1.709	18	0.709	3.24	0.5022	0.0209	0.205	0.0592
19	2.834	1.904	19	0.748	3.61	0.5596	0.0262	0.217	0.0696
20	3.140	2.110	20	0.787	4.00	0.6120	-	-	-
22	3.800	2.553	22	0.886	4.84	0.7502	0.0468	0.252	0.108
25	4.906	3.296	25	0.984	6.25	0.9688	0.0783	0.283	0.159
28	6.154	4.135	28	1.102	7.84	1.2150	0.1230	0.319	0.223
30	7.065	4.747	30	1.181	9.00	1.3950	0.1620	0.343	0.275
32	8.038	5.401	32	1.260	10.24	1.5870	0.2100	0.362	0.333
35	9.616	6.461	35	1.378	12.25	1.8990	0.3000	0.398	0.436
36	10.174	6.836	36	1.417	12.96	2.0090	0.3360	0.409	0.475
38	11.335	7.616	38	1.496	14.44	2.2380	0.4180	0.433	0.558
44	15.198	10.211	44	1.732	19.36	3.0010	-	-	-
50	19.625	13.186	50	1.969	25.00	3.8750	1.252	0.567	1.269
55	23.746	15.955	55	2.165	30.25	4.6890	1.833	0.626	1.690
60	28.260	18.988	60	2.362	36.00	5.5800	2.595	0.681	2.197
65	33.166	22.284	65	2.559	42.25	6.5490	3.580	0.740	2.795
70	38.465	25.845	70	2.756	49.00	7.5950	4.805	0.795	3.491
75	44.156	29.668	75	2.953	56.25	8.7190	6.342	0.854	4.290
80	50.240	33.756	80	3.150	64.00	9.9200	8.192	0.909	5.205
85	56.716	38.107	85	3.346	72.25	11.200	10.450	0.965	6.224
90	63.585	42.723	90	3.543	81.00	12.560	13.141	1.024	7.384
95	70.846	47.601	95	3.740	90.25	13.990	16.312	1.079	8.726
100	78.500	52.744	100	3.937	100.00	15.500	20.012	1.138	10.191
110	94.985	63.820	110	4.331	121.00	18.760	29.309	1.252	13.547
120	113.040	75.952	120	4.724	144.00	22.320	41.562	1.362	17.575
130	132.165	89.138	130	5.118	169.00	26.200	57.177	1.476	22.334
140	154.860	103.379	140	5.512	196.00	30.380	76.877	1.591	27.888
150	176.625	118.674	150	5.906	225.00	34.880	101.381	1.705	34.295
160	200.960	135.025	160	6.229	256.00	39.680	131.195	1.819	41.295

DEFORMED BAR

Section Size mm	Unit Weight M kg/m	Cross Sectional Area A cm^3
6	0.222	0.283
10	0.617	0.785
12	0.888	1.131
13	1.042	1.327
14	1.208	1.539
16	1.578	2.011
18	1.998	2.545
19	2.226	2.835
20	2.466	3.142
22	2.984	3.801
24	3.551	4.524
25	3.853	4.909
26	4.168	5.309
28	4.833	6.158
29	5.185	6.605
30	5.549	7.069
32	6.313	8.042
35	7.552	9.621
38	8.902	11.34

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STEEL BARS FOR CONCRETE REINFORCEMENT

SPECIFICATIONS AND GRADES

SPECIFICATION	GRADE	CHEMICAL COMPOSITION					TENSILE AND BEND TEST REQUIREMENTS			
		C.E. %	C %	P %	S %	N %	Yield Strength N/mm² (min.)	Tensile Strength N/mm² (min.)	Min. Elongation (Gauge Length L)	Bend Test
BS 4449:88 (Hot Rolled Steel Bars)	Grade 460 (High Yield Steel Bars)	Max 0.51	Max 0.25	Max 0.05	Max 0.05	Max 0.012	460	Actual Yield Stress x 1.10	12% (L = 5d)	Bend Angle (3d) = 180° Rebend (5d) = 1st bend 45° Rebend 23°
	Grade 250 (Mild Steel Bars)	Max 0.42	Max 0.25	Max 0.06	Max 0.06	Max 0.012	250		22% (L = 5d)	For All Sizes 2d former
MS 146:88 (Hot Rolled Steel Bars)	High Yield Steel Bars	Max 0.51	Max 0.25	Max 0.05	Max 0.05	N.A.	410 460	Actul Yield Stress	14% 12% (L = 5.56√So)	Bend Angle (3d) = 180° Rebend (5d) = 1st bend 45° Rebend 23°
	Mild Steel Bars	Max 0.42	Max 0.25	Max 0.06	Max 0.06	N.A.	250	x 1.05	22% (L = 5.56√So)	For All Sizes 2d former
ASTM A615-86 (Deformed and Plain Billet Steel Bars)	Grade 60 (Deformed and Plain Round Bars)	N.A.	- - -	Max 0.06	- - -	N.A.	60,000 (psi)	90,000 (psi)	Bar No. Elong 3, 4, 5, 6, 9% 7, 8, 8% 9, 10, 11, 14 7% (L = 8 inches)	Bar No. Dia 3, 4, 5, 3½d 6, 7, 8, 5d 9, 10, 11, 7d 14 9d
	Grade 40 (Deformed and Plain Round Bars)	N.A.	- - -	Max 0.06	- - -	N.A.	40,000 (psi)	70,000 (psi)	Bar No. Elong 3, 11% 4, 5, 6, 12% (L = 8 inches)	Bar No. Dia 3, 4, 5, 3½d 6, 5d

Remark: Chemical composition based on cast analysis.

BS = British Standard
MS = Malaysian Standard
ASTM = American Society for Testing Materials

d = nominal size of bar
So = the original cross-sectional area of the test piece
C.E. = $C + \frac{Mn}{6} + \frac{Cr + Mo}{5} + V + \frac{Ni + Cu}{15}$

WEIGHT TABLE-REBARS

Nominal Diameter mm	6	8	9	10	12	16	20	22	25	28	32	40
Cross-Sectional Area mm²	28.3	50.3	63.6	78.5	113.1	201.1	314.2	380.1	490.9	615.8	804.2	1256.6
Kg Per metre	0.222	0.395	0.499	0.6616	0.888	1.579	2.466	2.984	3.854	4.834	6.313	9.864