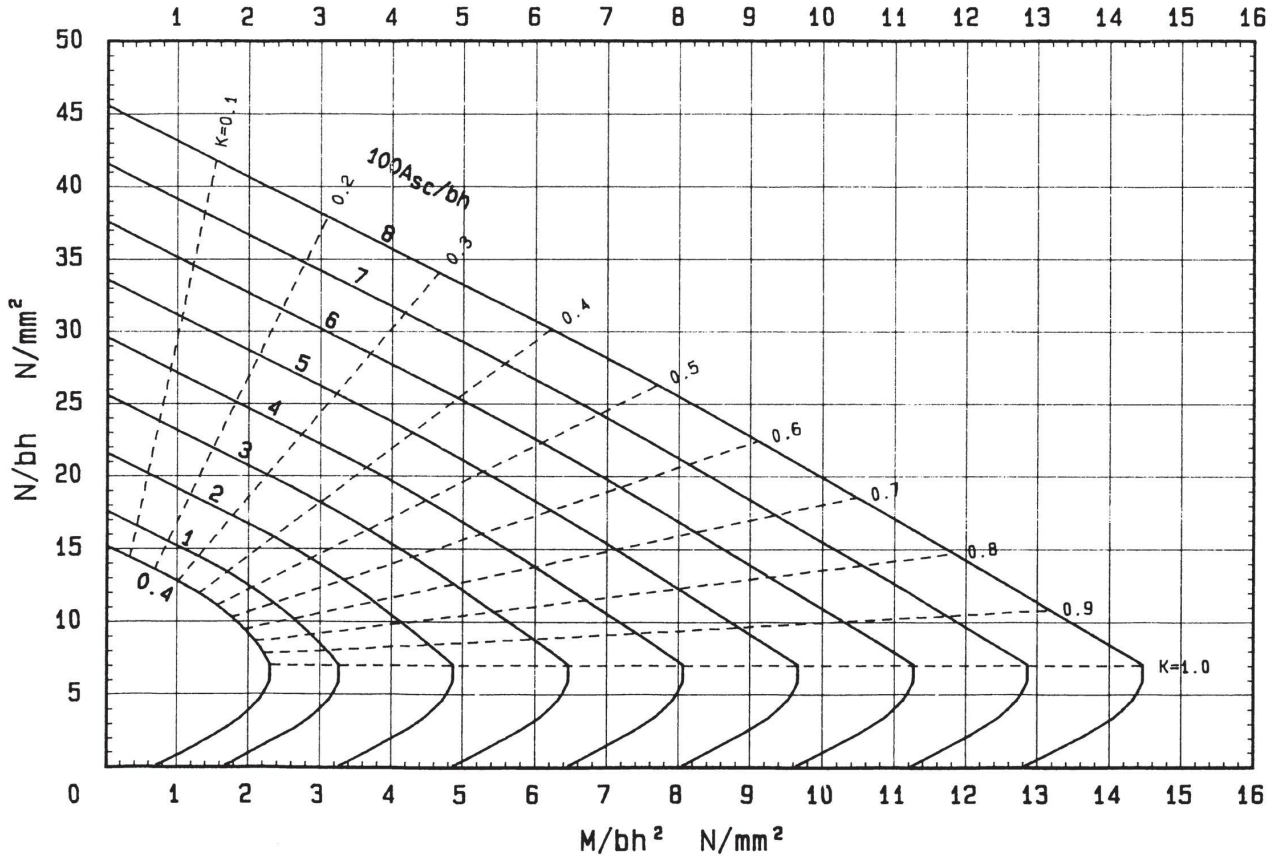
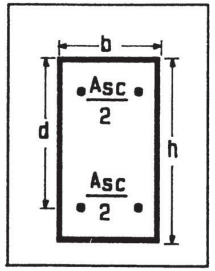
INTERACTION CURVES FOR COLUMN

CHART 29 OF BS8110-3:1985



Rectangular columns



f_{cu}	30
f_y	460
d/h	0.90

Output : percentage of steel (100Asc/bh)

Chart No. 29

- Input for the Interactive Curve :

Design of column for axial load and uniaxial BM

Enter the values in these cells only

Column dimensions

D/H =0.90

D=H*0.90

Breadth, 'b' =	250	mm
Depth, 'H' =	400	mm
Concrete grade, 'fck' =	30	Mpa
Yield strength of steel, fy	460	N/mm^2
Concrete cover to main bars	25	mm

Details of Reinforcement

Row_{1-6}	Nos. of bar	Bar Dia (mm)	Ast (mm^2)	d_{1-6} (mm)	$_{1-6}$ from CL (mm)
1	2	32	1608.50	41	159
6	2	32	1608.50	359	-159
		Total A_{st} =	**3242.00**	mm^2	

$$If\ \frac{x_u}{D} * D \leq D$$

$$P_u = f_{ck} * b * D * \left(C_1 * \frac{x_u}{D} + \sum \frac{P_i(f_{si} - f_{ci})}{fck} \right) * 10^{-3}$$

$$If\ \frac{x_u}{D} * D < D$$

$$P_u = f_{ck} * b * D * \left(C_1 + \sum \frac{P_i(f_{si} - f_{ci})}{fck} \right) * 10^{-3}$$

$$If\ \frac{x_u}{D} * D \leq D$$

$$M_u = f_{ck} * b * D^2 * \{C_1 * \frac{x_u}{D} * \left(0.5 - C_2 * \frac{x_u}{D}\right) + \sum \frac{p_i * (f_{si} - f_{ci})}{fck} * \frac{y_i}{D}\} * 10^{-3}$$

$$If\ \frac{x_u}{D} * D < D$$

$$M_u = f_{ck} * b * D^2 * \{C_1 * (0.5 - C_2) + \sum \frac{p_i * (f_{si} - f_{ci})}{fck} * \frac{y_i}{D}\} * 10^{-3}$$

$$If\ \frac{x_u}{D} * D \leq \frac{D}{2} - y_i$$

$$\frac{p_i * (f_{si} - f_{ci})}{fck} = \frac{y_1 * (-f_{si} - f_{ci})}{b * D * f_{ck}}$$

$$If\ \frac{x_u}{D} * D > \frac{D}{2} - y_i$$

$$\frac{p_i * (f_{si} - f_{ci})}{fck} = \frac{y_1 * (f_{si} - f_{ci})}{b * D * f_{ck}}$$

$$If\ \frac{x_u}{D} \leq 1,$$

$$C_1 = 0.446 * (1 - \frac{4}{21})$$

$$If\ \frac{x_u}{D} > 1,$$

$$C_1 = 0.446 * \frac{(1 - 4 * (\frac{4}{7 * \frac{x_u}{D} - 3})^2}{21}$$

$$If\ \frac{x_u}{D} \leq 1,$$

$$C_2 = \frac{\frac{0.446}{2} - 8 * \frac{0.446}{49}}{\frac{x_u}{D}}$$

$$If\ \frac{x_u}{D} > 1,$$

$$C_2 = \frac{\frac{0.446}{2} - 8 * 0.446 * \frac{(\frac{4}{7 * (\frac{x_u}{D} - 3)})^2}{49}}{\frac{x_u}{D}}$$

$$If\ \frac{D}{2} - y_i \leq \frac{3D}{7}$$

$$fs_i = 0.446 * f_{ck}$$

$$If\ \frac{D}{2} - y_i > \frac{3D}{7}$$

$$fs_i = 0.446 * f_{ck} - \frac{0.446 * f_{ck} * (y_i - \frac{3D}{7})}{(\frac{x_u}{D} * D - \frac{3D}{7})^2}$$

$$If\ \frac{x_u}{D} * D \leq D$$

$$es_i = 0.0035 * \frac{\frac{x_u}{D} * D - \frac{D}{2} + y_i}{\frac{x_u}{D} * D}$$

$$If\ \frac{x_u}{D} * D > D$$

$$es_i = 0.002 * \frac{\frac{x_u}{D} * D - \frac{D}{2} + y_i}{\frac{x_u}{D} * D - \frac{3D}{7}}$$

STRESS - STRAIN RELATIONSHIP OF STEEL BARS

Stress Level	Mild Steel bars		Cold Worked bars			
	f_y = 250 N/mm^2		f_y = 415 N/mm^2		f_y = 500 N/mm^2	
	Strain	Stress N/mm^2	Strain	Stress N/mm^2	Strain	Stress N/mm^2
0.80 f_{yd}	0.00087	174.000	0.00144	288.7	0.00174	347.8
0.85 f_{yd}	0.00092	184.875	0.00163	306.7	0.00195	369.6
0.90 f_{yd}	0.00098	195.750	0.00192	324.8	0.00226	391.3
0.95 f_{yd}	0.00103	206.625	0.00241	342.8	0.00277	413.0
0.975 f_{yd}	0.00106	212.062	0.00276	351.8	0.00312	423.9
1.0 f_{yd}	0.00109	217.500	0.00380	360.9	0.00417	434.8

Note: 1.0 f_{yd} = 0.87 f_y, Linear interpolation is done for intermediate values.

Pu (kN)	Mu (kN.m)	Mu\bh^2	Pu/bh
-1287.439749	0	0	-12.87439749
-563.55	117.73	2.94325	-5.6355
-327.17	155.41	3.88525	-3.2717
-146.22	184.06	4.6015	-1.4622
-9.22	205.48	5.137	-0.0922
100.28	222.32	5.558	1.0028
191.48	236.01	5.90025	1.9148
249.26	244.17	6.10425	2.4926
276.34	247.22	6.1805	2.7634
303.42	250.04	6.251	3.0342
330.49	252.64	6.316	3.3049
357.57	255.02	6.3755	3.5757
384.65	257.17	6.42925	3.8465
411.73	259.09	6.47725	4.1173
438.81	260.79	6.51975	4.3881
465.89	262.26	6.5565	4.6589
492.97	263.51	6.58775	4.9297
520.04	264.54	6.6135	5.2004
547.12	265.33	6.63325	5.4712
574.2	265.91	6.64775	5.742
613.49	264.31	6.60775	6.1349
713.8	252.79	6.31975	7.138
808.24	241.97	6.04925	8.0824
897.51	231.76	5.794	8.9751
982.17	222.05	5.55125	9.8217

1062.72	**212.77**	**5.31925**	**10.6272**
1139.57	203.85	5.09625	11.3957
1213.11	195.23	4.88075	12.1311
1283.66	186.86	4.6715	12.8366
1351.48	178.71	4.46775	13.5148
1416.84	170.71	4.26775	14.1684
1479.94	162.85	4.07125	14.7994
1540.99	155.1	3.8775	15.4099
1599.92	147.45	3.68625	15.9992
1655.26	140.15	3.50375	16.5526
1709.29	132.83	3.32075	17.0929
1762.08	125.49	3.13725	17.6208
1813.72	118.1	2.9525	18.1372
1855.58	111.78	2.7945	18.5558
1893.32	106.08	2.652	18.9332
1927.52	100.91	2.52275	19.2752
1958.62	96.19	2.40475	19.5862
1987.03	91.89	2.29725	19.8703
2013.06	87.94	2.1985	20.1306
2037	84.3	2.1075	20.37
2059.08	80.94	2.0235	20.5908
2079.51	77.84	1.946	20.7951
2098.45	74.95	1.87375	20.9845
2116.07	72.26	1.8065	21.1607
2132.49	69.76	1.744	21.3249
2147.83	67.42	1.6855	21.4783
2162.19	65.22	1.6305	21.6219
2175.66	63.17	1.57925	21.7566
2188.32	61.23	1.53075	21.8832
2200.23	59.41	1.48525	22.0023
2211.46	57.68	1.442	22.1146
2222.07	56.06	1.4015	22.2207
2232.11	54.52	1.363	22.3211
2241.61	53.06	1.3265	22.4161
2250.62	51.68	1.292	22.5062
2259.18	50.36	1.259	22.5918
2267.32	49.11	1.22775	22.6732
2275.07	47.92	1.198	22.7507
2282.45	46.79	1.16975	22.8245
2289.49	45.7	1.1425	22.8949

2296.22	**44.67**	**1.11675**	**22.9622**
2302.65	43.67	1.09175	23.0265
2308.8	42.73	1.06825	23.088
2314.7	41.82	1.0455	23.147
2320.34	40.95	1.02375	23.2034
2325.76	40.11	1.00275	23.2576
2330.97	39.31	0.98275	23.3097
2335.97	38.53	0.96325	23.3597
2340.78	37.79	0.94475	23.4078
2345.4	37.08	0.927	23.454
2349.86	36.39	0.90975	23.4986
2354.15	35.72	0.893	23.5415
2358.29	35.08	0.877	23.5829
2418.13	25.8	0.645	24.1813
2452.87	20.39	0.50975	24.5287
2475.52	16.85	0.42125	24.7552
2491.44	14.35	0.35875	24.9144