Missouri Department of Transportation

Bridge Division

Bridge Design Manual

Section 1.5

Revised 03/09/2000

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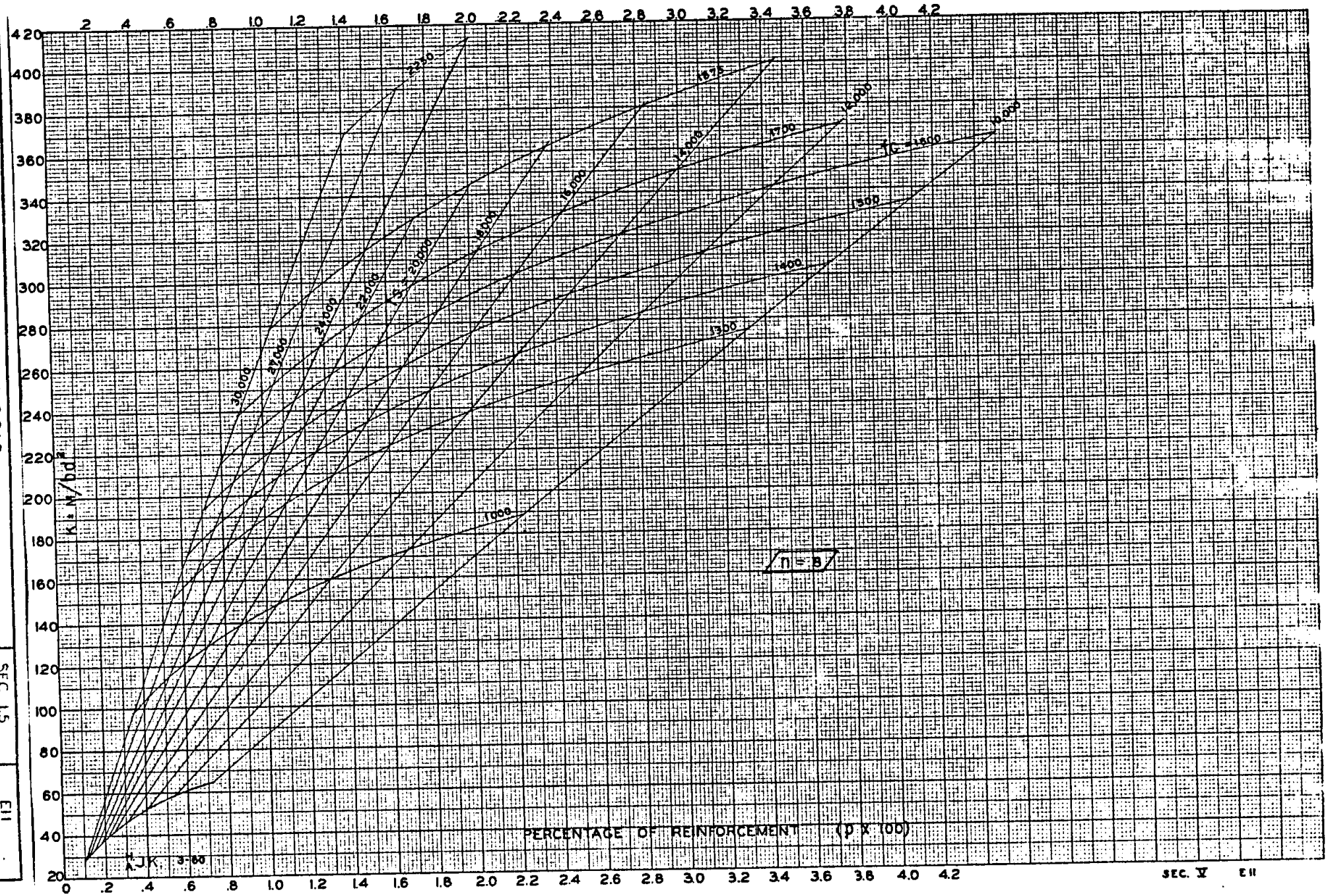
AREA OF STEEL

SPACING

SIZE	4"	4½"	5"	5½"	6"	6½"	7"	7½"	8"	8½"	9"	9½"	10"	10½"	11"	11½"	12"	SIZE
3	.332	.295	.265	.241	.221	.204	.189	.177	.166	.156	.147	.140	.133	.126	.121	.115	.111	3
4	.589	.524	.471	.429	.393	.363	.337	.314	.295	.277	.262	.248	.236	.224	.214	.205	.196	4
5	.920	.818	.736	.669	.614	.566	.526	.491	.460	.433	.409	.388	.368	.351	.335	.320	.307	5
6	1.325	1.178	1.050	.964	.884	.816	.757	.707	.663	.624	.589	.558	.530	.505	.482	.461	.442	6
7	1.804	1.603	1.443	1.312	1.203	1.110	1.031	.962	.902	.849	.802	.760	.722	.687	.656	.627	.601	7
8	2.356	2.094	1.885	1.714	1.571	1.450	1.346	1.257	1.178	1.109	1.047	.992	.942	.898	.857	.820	.785	8
9	3.00	2.67	2.40	2.18	2.00	1.85	1.71	1.60	1.50	1.41	1.33		1.20		1.09		1.00	9
10		3.37	3.04	2.76	2.53	2.34	2.17	2.02	1.90	1.79	1.69		1.52		1.38		1.27	10
11			3.75	3.41	3.13	2.88	2.68	2.50	2.34	2.21	2.08		1.88		1.70		1.56	11

NUMBER OF BARS

SIZE	Perimeter	Wt. Per Ft.	Diameter (inches)	1	2	3	4	5	6	7	8	9	10	SIZE
3	1.178	.376	.375	.1105	0.22	0.33	0.44	0.55	0.66	0.77	0.88	0.99	1.105	3
4	1.571	.668	.500	.1963	0.39	0.59	0.79	0.98	1.18	1.37	1.57	1.77	1.96	4
5	1.963	1.043	.625	.3068	0.61	0.92	1.23	1.53	1.84	2.15	2.45	2.76	3.07	5
6	2.356	1.502	.750	.4418	0.88	1.33	1.77	2.21	2.65	3.09	3.53	3.98	4.42	6
7	2.749	2.044	.875	.6013	1.20	1.80	2.41	3.01	3.61	4.21	4.81	5.41	6.01	7
8	3.142	2.670	1.000	.7854	1.57	2.36	3.14	3.93	4.71	5.50	6.28	7.07	7.85	8
9	3.544	3.400	1.128	1.0000	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	9
10	3.990	4.303	1.270	1.2656	2.53	3.80	5.06	6.33	7.59	8.86	10.12	11.39	12.66	10
11	4.430	5.313	1.410	1.5625	3.12	4.69	6.25	7.81	9.37	10.94	12.50	14.06	15.63	11
14S	5.32	7.65	1.693	2.2500	4.50	6.75	9.00	11.25	13.50	15.75	18.00	20.25	22.50	14S
18S	7.09	13.60	2.257	4.0000	8.00	12.00	16.00	20.00	24.00	28.00	32.00	36.00	40.00	18S



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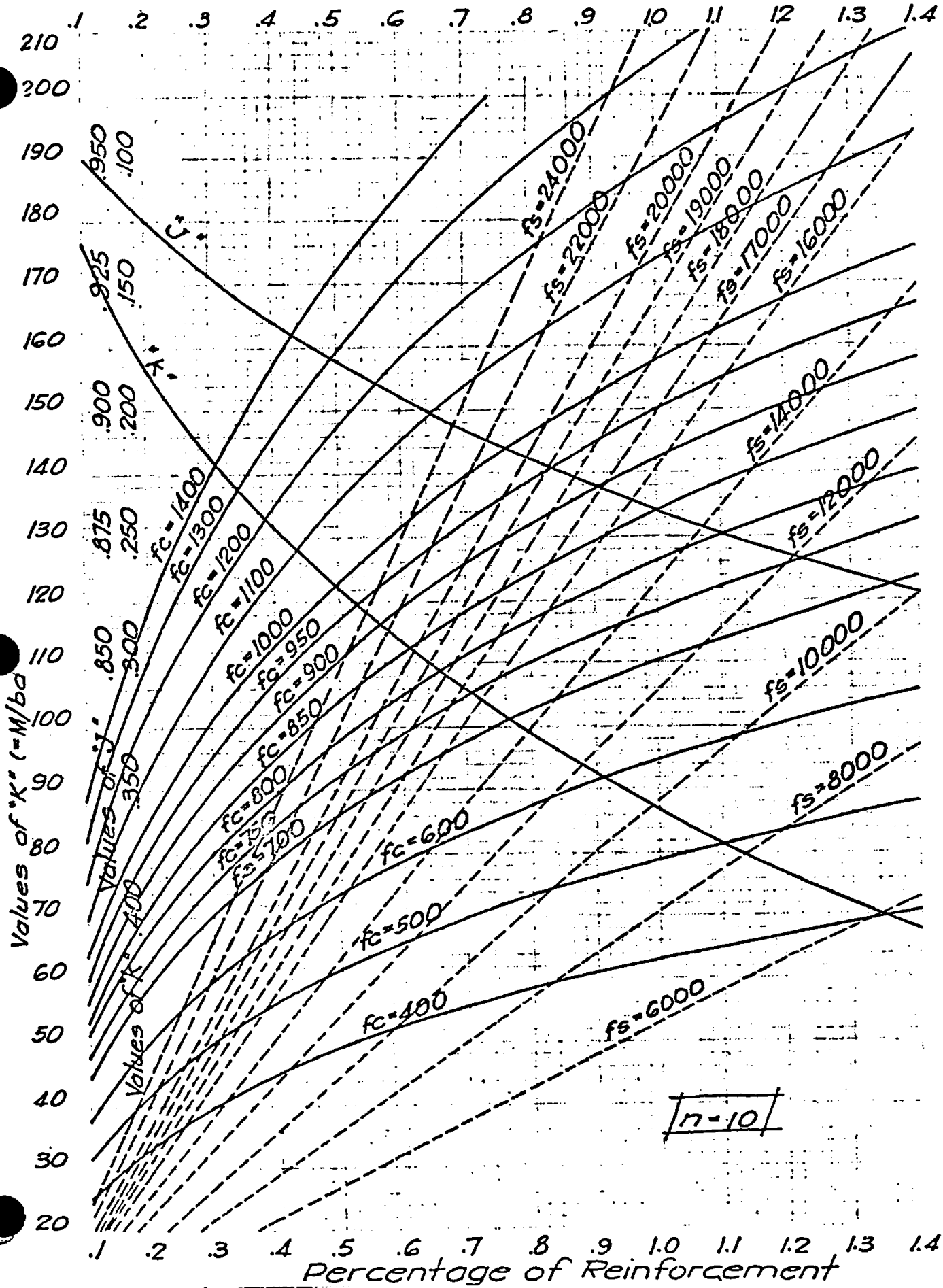
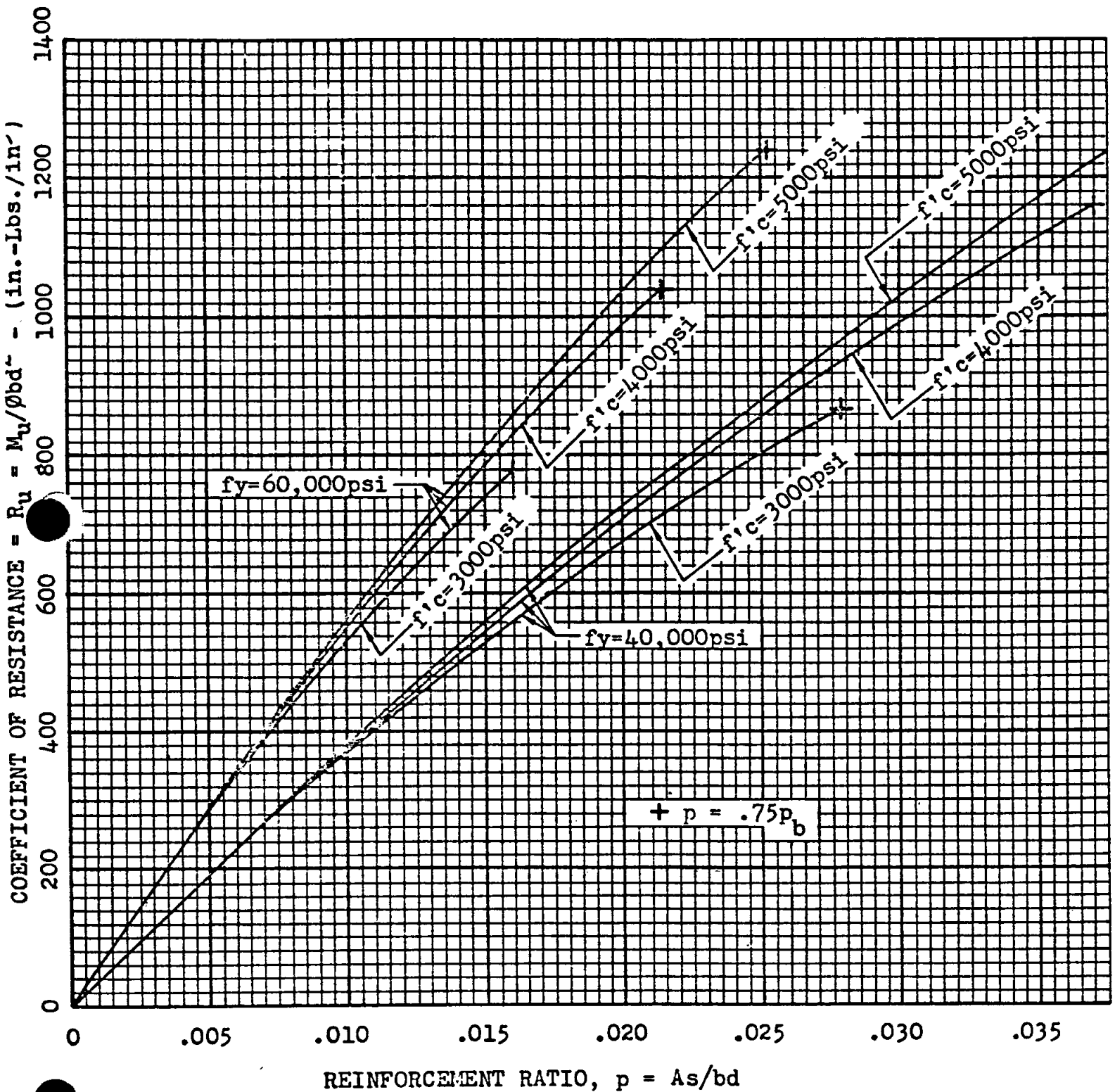
E11

VALUES OF "J" "k" & "K" FOR REINF. CONC. RECT. BEAMS & SLABS



STRENGTH CURVES (R_u vs. p) FOR GRADE 40 & 60 REINFORCEMENT

(RECTANGULAR SECTIONS WITH TENSION REINFORCEMENT ONLY)



STRENGTH TABLES (Ru vs. p) FOR GRADE 60 REINFORCEMENT
(RECTANGULAR AND SQUARE SECTIONS WITH TENSION REINFORCEMENT ONLY)

f'c = 3,000 p.s.i.

Ru	p	Ru	p	Ru	p	Ru	p	Ru	p
20	0.0003	195	0.0034	365	0.0066	535	0.0101	705	0.0141
25	0.0004	200	0.0035	370	0.0067	540	0.0102	710	0.0142
30	0.0005			375	0.0068	545	0.0103	715	0.0143
35	0.0006	205	0.0036	380	0.0069	550	0.0105	720	0.0145
40	0.0007	210	0.0037	385	0.0070	555	0.0106	725	0.0146
45	0.0008	215	0.0037	390	0.0071	560	0.0107	730	0.0147
50	0.0008	220	0.0038	395	0.0072	565	0.0108	735	0.0148
55	0.0009	225	0.0039	400	0.0073	570	0.0109	740	0.0150
60	0.0010	230	0.0040			575	0.0110	745	0.0151
65	0.0011	235	0.0041	405	0.0074	580	0.0111	750	0.0152
70	0.0012	240	0.0042	410	0.0075	585	0.0112	755	0.0154
75	0.0013	245	0.0043	415	0.0076	590	0.0113	760	0.0155
80	0.0014	250	0.0044	420	0.0077	595	0.0115	765	0.0156
85	0.0014	255	0.0045	425	0.0078	600	0.0116	770	0.0158
90	0.0015	260	0.0046	430	0.0079			775	0.0159
95	0.0016	265	0.0047	435	0.0080	605	0.0117	780	0.0160
100	0.0017	270	0.0048	440	0.0081	610	0.0118		
		275	0.0049	445	0.0082	615	0.0119		
105	0.0018	280	0.0050	450	0.0083	620	0.0120		
110	0.0019	285	0.0051	455	0.0084	625	0.0122		
115	0.0020	290	0.0051	460	0.0085	630	0.0123		
120	0.0020	295	0.0052	465	0.0086	635	0.0124		
125	0.0021	300	0.0053	470	0.0087	640	0.0125		
130	0.0022			475	0.0088	645	0.0126		
135	0.0023	305	0.0054	480	0.0089	650	0.0127		
140	0.0024	310	0.0055	485	0.0090	655	0.0129		
145	0.0025	315	0.0056	490	0.0092	660	0.0130		
150	0.0026	320	0.0057	495	0.0093	665	0.0131		
155	0.0027	325	0.0058	500	0.0094	670	0.0132		
160	0.0028	330	0.0059			675	0.0133		
165	0.0028	335	0.0060	505	0.0095	680	0.0135		
170	0.0029	340	0.0061	510	0.0096	685	0.0136		
175	0.0030	345	0.0062	515	0.0097	690	0.0137		
180	0.0031	350	0.0063	520	0.0098	695	0.0138		
185	0.0032	355	0.0064	525	0.0099	700	0.0140		
190	0.0033	360	0.0065	530	0.0100				

Design Stresses:
- Concrete f'c = 3,000 p.s.i.
- Reinforcing Steel Fy = 60,000 p.s.i.

Formulae:

$Ru = Mu \div (0.9 \times b \times d^2)$ Ru units = (in.-lbs./in.^{3})

$As = [(b \times d)\ p]$

Note: If Fy = 40,000 p.s.i.
then $As = [(b \times d)(p \times 1.5)]$

STRENGTH TABLES (Ru vs. p) FOR GRADE 60 REINFORCEMENT

(RECTANGULAR AND SQUARE SECTIONS WITH TENSION REINFORCEMENT ONLY)

f'c = 4,000 p.s.i.

Ru	p	Ru	p	Ru	p	Ru	p	Ru	p
20	0.0003	230	0.0040	435	0.0078	640	0.0119	845	0.0165
25	0.0004	235	0.0041	440	0.0079	645	0.0120	850	0.0166
30	0.0005	240	0.0042	445	0.0080	650	0.0121	855	0.0167
35	0.0006	245	0.0042	450	0.0081	655	0.0122	860	0.0168
40	0.0007	250	0.0043	455	0.0082	660	0.0123	865	0.0170
45	0.0008	255	0.0044	460	0.0083	665	0.0125	870	0.0171
50	0.0008	260	0.0045	465	0.0084	670	0.0126	875	0.0172
55	0.0009	265	0.0046	470	0.0085	675	0.0127	880	0.0173
60	0.0010	270	0.0047	475	0.0086	680	0.0128	885	0.0174
65	0.0011	275	0.0048	480	0.0087	685	0.0129	890	0.0176
70	0.0012	280	0.0049	485	0.0088	690	0.0130	895	0.0177
75	0.0013	285	0.0050	490	0.0089	695	0.0131	900	0.0178
80	0.0013	290	0.0051	495	0.0090	700	0.0132		
85	0.0014	295	0.0052	500	0.0091			905	0.0179
90	0.0015	300	0.0052			705	0.0133	910	0.0180
95	0.0016			505	0.0092	710	0.0134	915	0.0182
100	0.0017	305	0.0053	510	0.0093	715	0.0135	920	0.0183
		310	0.0054	515	0.0094	720	0.0136	925	0.0184
105	0.0018	315	0.0055	520	0.0095	725	0.0138	930	0.0185
110	0.0019	320	0.0056	525	0.0096	730	0.0139	935	0.0187
115	0.0020	325	0.0057	530	0.0097	735	0.0140	940	0.0188
120	0.0020	330	0.0058	535	0.0098	740	0.0141	945	0.0189
125	0.0021	335	0.0059	540	0.0099	745	0.0142	950	0.0190
130	0.0022	340	0.0060	545	0.0100	750	0.0143	955	0.0192
135	0.0023	345	0.0061	550	0.0101	755	0.0144	960	0.0193
140	0.0024	350	0.0062	555	0.0102	760	0.0145	965	0.0194
145	0.0025	355	0.0063	560	0.0103	765	0.0146	970	0.0195
150	0.0026	360	0.0064	565	0.0104	770	0.0148	975	0.0197
155	0.0027	365	0.0065	570	0.0105	775	0.0149	980	0.0198
160	0.0028	370	0.0065	575	0.0106	780	0.0150	985	0.0199
165	0.0028	375	0.0066	580	0.0107	785	0.0151	990	0.0200
170	0.0029	380	0.0067	585	0.0108	790	0.0152	995	0.0202
175	0.0030	385	0.0068	590	0.0109	795	0.0153	1000	0.0203
180	0.0031	390	0.0069	595	0.0110	800	0.0154		
185	0.0032	395	0.0070	600	0.0111			1005	0.0204
190	0.0033	400	0.0071			805	0.0156	1010	0.0206
195	0.0033			605	0.0112	810	0.0157	1015	0.0207
200	0.0034	405	0.0072	610	0.0113	815	0.0158	1020	0.0208
205	0.0035	410	0.0073	615	0.0114	820	0.0159	1025	0.0210
210	0.0036	415	0.0074	620	0.0115	825	0.0160	1030	0.0211
215	0.0037	420	0.0075	625	0.0116	830	0.0161	1035	0.0212
220	0.0038	425	0.0076	630	0.0117	835	0.0162	1040	0.0214
225	0.0039	430	0.0077	635	0.0118	840	0.0164		

Design Stresses:

Concrete f'c = 4,000 p.s.i.

Reinforcing Steel Fy = 60,000 p.s.i.

Formulae:

$Ru = Mu \div (0.9 \times b \times d^2)$

$As = [(b \times d)\ p]$

Ru units = (in.-lbs./in.^{3})

Note: If Fy = 40,000 p.s.i. then $As = [(b \times d)(p \times 1.5)]$

RECTANGULAR BEAMS
WORKING STRESS
(GRADE 40 REINFORCEMENT)

f_s = 20000 psi
f'c = 4000 psi
n = 8
P = % Reinforcement

$$K = \frac{M}{bd^2} \qquad P = \frac{A_s}{bd}$$

K	P	K	P	K	P	K	P
19	.0010	88	.0048	154	.0086	218	.0124
21	.0011	90	.0049	156	.0087	220	.0125
23	.0012	92	.0050	158	.0088	222	.0126
25	.0013	94	.0051	159	.0089	223	.0127
27	.0014	95	.0052	161	.0090	225	.0128
29	.0015	97	.0053	163	.0091	227	.0129
30	.0016	99	.0054	165	.0092	228	.0130
32	.0017	101	.0055	166	.0093	230	.0131
34	.0018	102	.0056	168	.0094	232	.0132
36	.0019	104	.0057	170	.0095	233	.0133
38	.0020	106	.0058	171	.0096	235	.0134
40	.0021	108	.0059	173	.0097	237	.0135
41	.0022	109	.0060	175	.0098	238	.0136
43	.0023	111	.0061	176	.0099	240	.0137
45	.0024	113	.0062	178	.0100	242	.0138
47	.0025	115	.0063	180	.0101	243	.0139
49	.0026	116	.0064	182	.0102	245	.0140
51	.0027	118	.0065	183	.0103	247	.0141
52	.0028	120	.0066	185	.0104	248	.0142
54	.0029	122	.0067	187	.0105	250	.0143
56	.0030	123	.0068	188	.0106	252	.0144
58	.0031	125	.0069	190	.0107	253	.0145
60	.0032	127	.0070	192	.0108	255	.0146
61	.0033	129	.0071	193	.0109	257	.0147
63	.0034	130	.0072	195	.0110	258	.0148
65	.0035	132	.0073	197	.0111	260	.0149
67	.0036	134	.0074	198	.0112	262	.0150
69	.0037	135	.0075	200	.0113	263	.0151
70	.0038	137	.0076	202	.0114	265	.0152
72	.0039	139	.0077	203	.0115	266	.0153
74	.0040	141	.0078	205	.0116	268	.0154
76	.0041	142	.0079	207	.0117	270	.0155
78	.0042	144	.0080	208	.0118	271	.0156
79	.0043	146	.0081	210	.0119	273	.0157
81	.0044	147	.0082	212	.0120	275	.0158
83	.0045	149	.0083	213	.0121		
85	.0046	151	.0084	215	.0122		
87	.0047	153	.0085	217	.0123		

RECTANGULAR BEAMS
WORKING STRESS
(GRADE 40 REINFORCEMENT)

f_s = 20000 psi
f'c = 3000 psi
n = 10
P = % Reinforcement

$$K = \frac{M}{bd^2} \qquad P = \frac{A_s}{bd}$$

K	P
19	.0010
21	.0011
23	.0012
25	.0013
27	.0014
28	.0015
30	.0016
32	.0017
34	.0018
36	.0019
38	.0020
39	.0021
41	.0022
43	.0023
45	.0024
47	.0025
48	.0026
50	.0027
52	.0028
54	.0029
56	.0030
57	.0031
59	.0032
61	.0033
63	.0034
65	.0035
66	.0036
68	.0037
70	.0038
72	.0039
73	.0040
75	.0041
77	.0042
79	.0043
80	.0044
82	.0045
84	.0046

K	P
86	.0047
88	.0048
89	.0049
91	.0050
93	.0051
94	.0052
96	.0053
98	.0054
100	.0055
101	.0056
103	.0057
105	.0058
107	.0059
108	.0060
110	.0061
112	.0062
114	.0063
115	.0064
117	.0065
119	.0066
120	.0067
122	.0068
124	.0069
126	.0070
127	.0071
129	.0072
131	.0073
132	.0074
134	.0075
136	.0076
137	.0077
139	.0078
141	.0079
143	.0080
144	.0081
146	.0082
148	.0083

K	P
149	.0084
151	.0085
153	.0086
154	.0087
156	.0088
158	.0089
159	.0090
161	.0091
163	.0092
164	.0093
166	.0094
168	.0095
169	.0096
171	.0097
173	.0098
174	.0099
176	.0100
178	.0101
179	.0102
181	.0103
183	.0104
184	.0105
186	.0106
188	.0107
189	.0108
191	.0109
193	.0110
194	.0111
196	.0112
198	.0113
199	.0114
201	.0115
203	.0116
204	.0117
206	.0118
208	.0119

RECTANGULAR BEAMS
WORKING STRESS (GRADE 60 REINFORCEMENT)

f_s = 24000 psi
$f'c$ = 4000 psi $K = \frac{M}{bd^2}$ $P = \frac{A_s}{bd}$
n = 8
P = % Reinforcement

K	P	K	P	K	P	K	P
23	.0010	112	.0051	197	.0092	280	.0133
25	.0011	114	.0052	200	.0093	282	.0134
28	.0012	117	.0053	202	.0094	284	.0135
30	.0013	119	.0054	204	.0095	286	.0136
32	.0014	121	.0055	206	.0096	288	.0137
34	.0015	123	.0056	208	.0097	290	.0138
37	.0016	125	.0057	210	.0098	292	.0139
39	.0017	127	.0058	212	.0099	294	.0140
41	.0018	129	.0059	214	.0100	296	.0141
43	.0019	131	.0060	216	.0101	298	.0142
45	.0020	133	.0061	218	.0102	300	.0143
48	.0021	135	.0062	220	.0103	302	.0144
50	.0022	138	.0063	222	.0104	304	.0145
52	.0023	140	.0064	224	.0105	306	.0146
54	.0024	142	.0065	226	.0106	308	.0147
56	.0025	144	.0066	228	.0107	310	.0148
59	.0026	146	.0067	230	.0108	312	.0149
61	.0027	148	.0068	232	.0109	314	.0150
63	.0028	150	.0069	234	.0110		
65	.0029	152	.0070	236	.0111		
67	.0030	154	.0071	238	.0112		
69	.0031	156	.0072	240	.0113		
72	.0032	158	.0073	242	.0114		
74	.0033	160	.0074	244	.0115		
76	.0034	163	.0075	246	.0116		
78	.0035	165	.0076	248	.0117		
80	.0036	167	.0077	250	.0118		
82	.0037	169	.0078	252	.0119		
85	.0038	171	.0079	254	.0120		
87	.0039	173	.0080	256	.0121		
89	.0040	175	.0081	258	.0122		
91	.0041	177	.0082	260	.0123		
93	.0042	179	.0083	262	.0124		
95	.0043	181	.0084	264	.0125		
97	.0044	183	.0085	266	.0126		
100	.0045	185	.0086	268	.0127		
102	.0046	187	.0087	270	.0128		
104	.0047	189	.0088	272	.0129		
106	.0048	191	.0089	274	.0130		
108	.0049	193	.0090	276	.0131		
110	.0050	195	.0091	278	.0132		

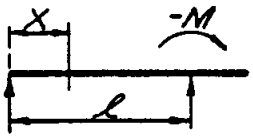
RECTANGULAR BEAMS
WORKING STRESS (GRADE 60 REINFORCEMENT)

f_s = 24000 psi
$f'c$ = 3000 psi
n = 10
P = % Reinforcement

$$K = \frac{M}{bd^2} \qquad P = \frac{A_s}{bd}$$

K	P	K	P	K	P	K	P
23	.0010	111	.0051	195	.0092	277	.0133
25	.0011	113	.0052	197	.0093	279	.0134
27	.0012	115	.0053	199	.0094	281	.0135
30	.0013	118	.0054	201	.0095	283	.0136
32	.0014	120	.0055	203	.0096	285	.0137
34	.0015	122	.0056	205	.0097	286	.0138
36	.0016	124	.0057	207	.0098	288	.0139
39	.0017	126	.0058	209	.0099	290	.0140
41	.0018	128	.0059	211	.0100	292	.0141
43	.0019	130	.0060	213	.0101	294	.0142
45	.0020	132	.0061	215	.0102	296	.0143
47	.0021	134	.0062	217	.0103	298	.0144
49	.0022	136	.0063	219	.0104	300	.0145
52	.0023	138	.0064	221	.0105	302	.0146
54	.0024	140	.0065	223	.0106	304	.0147
56	.0025	142	.0066	225	.0107	306	.0148
58	.0026	144	.0067	227	.0108	308	.0149
60	.0027	146	.0068	229	.0109	310	.0150
62	.0028	149	.0069	231	.0110		
65	.0029	151	.0070	233	.0111		
67	.0030	153	.0071	235	.0112		
69	.0031	155	.0072	237	.0113		
71	.0032	157	.0073	239	.0114		
73	.0033	159	.0074	241	.0115		
75	.0034	161	.0075	243	.0116		
78	.0035	163	.0076	245	.0117		
80	.0036	165	.0077	247	.0118		
82	.0037	167	.0078	249	.0119		
84	.0038	169	.0079	251	.0120		
86	.0039	171	.0080	253	.0121		
88	.0040	173	.0081	255	.0122		
90	.0041	175	.0082	257	.0123		
92	.0042	177	.0083	259	.0124		
94	.0043	179	.0084	261	.0125		
97	.0044	181	.0085	263	.0126		
99	.0045	183	.0086	265	.0127		
101	.0046	185	.0087	267	.0128		
103	.0047	187	.0088	269	.0129		
105	.0048	189	.0089	271	.0130		
107	.0049	191	.0090	273	.0131		
109	.0050	193	.0091	275	.0132		

DEFLECTIONS



Neg. Moment at Support

$\Delta X = \frac{-MX}{6EI\ell}(\ell^2 - X^2)$

When $X = \ell/4$

$\Delta X = \frac{-15M\ell^2}{384EI}$

When $X = \ell/3$

$\Delta X = \frac{-4M\ell^2}{81EI}$

When $X = \ell/2$

$\Delta X = \frac{-M\ell^2}{16EI}$

When $X = 2\ell/3$

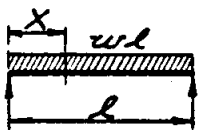
$\Delta X = \frac{-5M\ell^2}{81EI}$

When $X = 3\ell/4$

$\Delta X = \frac{-7M\ell^2}{128EI}$

When Δ at ℄ is given

$\Delta^{\ell/8} = \Delta^{\ell/2} \times .328$
$\Delta^{\ell/4} = \Delta^{\ell/2} \times .625$
$\Delta^{\ell/3} = \Delta^{\ell/2} \times .790$
$\Delta^{3\ell/8} = \Delta^{\ell/2} \times .859$
$\Delta^{5\ell/8} = \Delta^{\ell/2} \times 1.015$
$\Delta^{2\ell/3} = \Delta^{\ell/2} \times .988$
$\Delta^{3\ell/4} = \Delta^{\ell/2} \times .875$
$\Delta^{7\ell/8} = \Delta^{\ell/2} \times .547$



Uniform Load

$\Delta X = \frac{wX}{24EI}(\ell^3 - 2\ell X^2 + X^3)$

When $X = \ell/4 = 3\ell/4$

$\Delta X = \frac{19w\ell^4}{2048EI}$

When $X = \ell/3 = 2\ell/3$

$\Delta X = \frac{11w\ell^4}{972EI}$

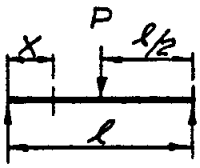
When $X = \ell/2$

$\Delta X = \frac{5w\ell^4}{384EI}$

When Δ at ℄ is given

$\Delta^{\ell/8} = \Delta^{\ell/2} \times .389$
$\Delta^{\ell/4} = \Delta^{\ell/2} \times .7125$
$\Delta^{\ell/3} = \Delta^{\ell/2} \times .8690$
$\Delta^{3\ell/8} = \Delta^{\ell/2} \times .925$

ℓ = ft.
E = #/□"
I = in^4
Δ = inches *
w = #/ft.



Conc. Load at ℄

$\Delta X = \frac{PX}{48EI}(3\ell^2 - 4X^2)$

When $X = \ell/4 = 3\ell/4$

$\Delta X = \frac{11P\ell^3}{768EI}$

When $X = \ell/3 = 2\ell/3$

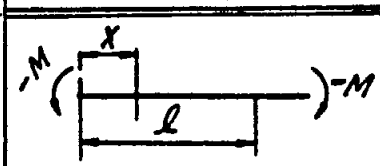
$\Delta X = \frac{23P\ell^3}{1296EI}$

When $X = \ell/2$

$\Delta X = \frac{P\ell^3}{48EI}$

When Δ at ℄ is given

$\Delta^{\ell/8} = \Delta^{\ell/2} \times .367$
$\Delta^{\ell/4} = \Delta^{\ell/2} \times .688$
$\Delta^{\ell/3} = \Delta^{\ell/2} \times .8525$
$\Delta^{3\ell/8} = \Delta^{\ell/2} \times .867$



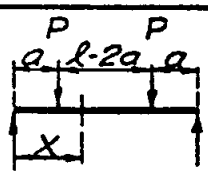
Equal Moments @ both supports

When $X = \ell/2$

$\Delta X = -\frac{M\ell^2}{8EI}$

When Δ @ ℄ is given

$\Delta^{\ell/4} = \Delta^{3\ell/4} = \Delta^{\ell/2} \times .75$



Equal Conc. Loads

When $X > a$ and $< (\ell - a)$

$\Delta X = \frac{Pa}{6EI}(3\ell X - 3X^2 - a^2)$

When $X = a = \ell/4$

$\Delta X = \frac{P\ell^3}{48EI}$

When $X = a = \ell/3$

$\Delta X = \frac{5P\ell^3}{162EI}$

When loads are at ¼ points, Δ at ℄ $= \frac{11P\ell^3}{384EI}$

$\Delta^{\ell/4} = \Delta^{\ell/2} \times .7275$

When loads are at ⅓ points, Δ at ℄ $= \frac{23P\ell^3}{648EI}$

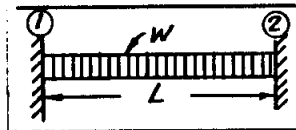
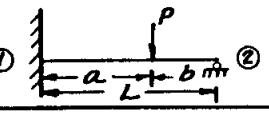
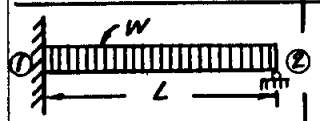
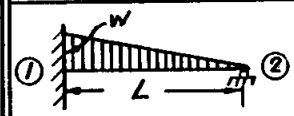
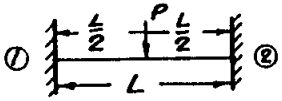
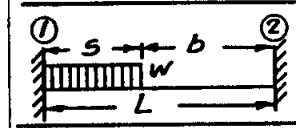
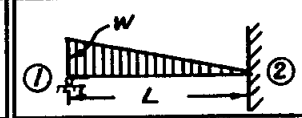
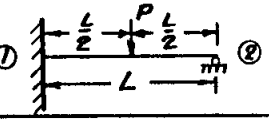
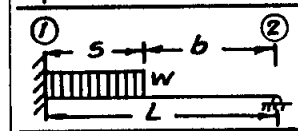
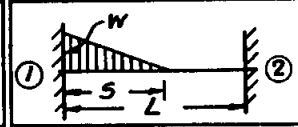
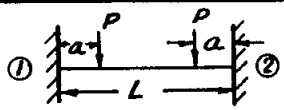
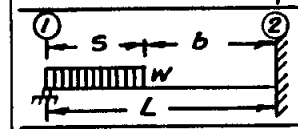
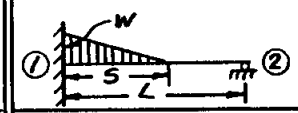
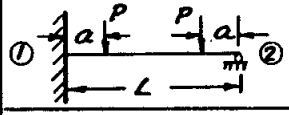
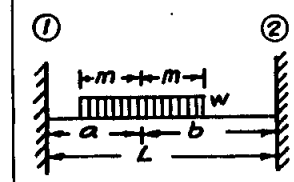
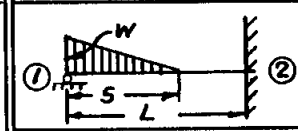
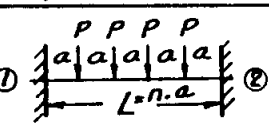
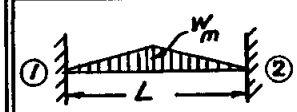
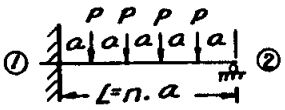
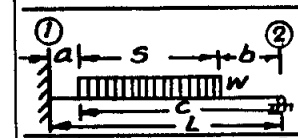
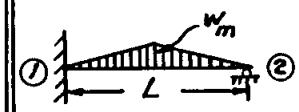
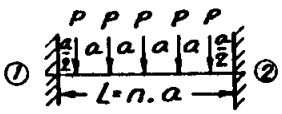
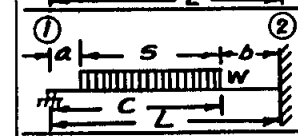
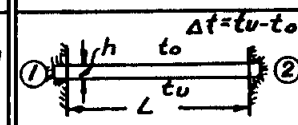
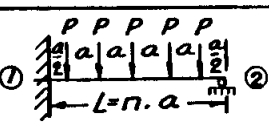
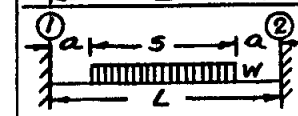
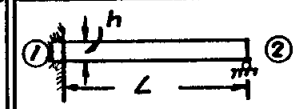
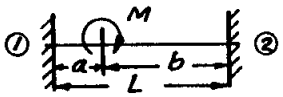
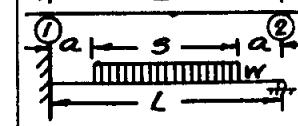
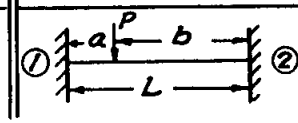
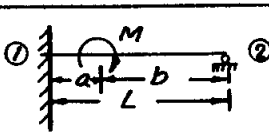
$\Delta^{\ell/3} = \Delta^{\ell/2} \times .869$

Note:
Two equal loads at ¼ points will give $\frac{11}{8} \times \Delta$ at ℄ for one load at ℄.

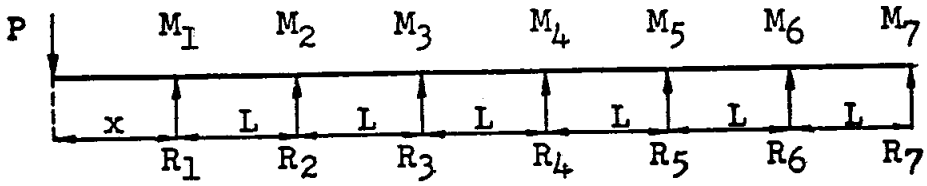
*Note: In order to obtain Δ in inches the answer must be multiplied by the constant $12^3 = 1728$.

FIXED END MOMENTS

for girders with constant moment of inertia.

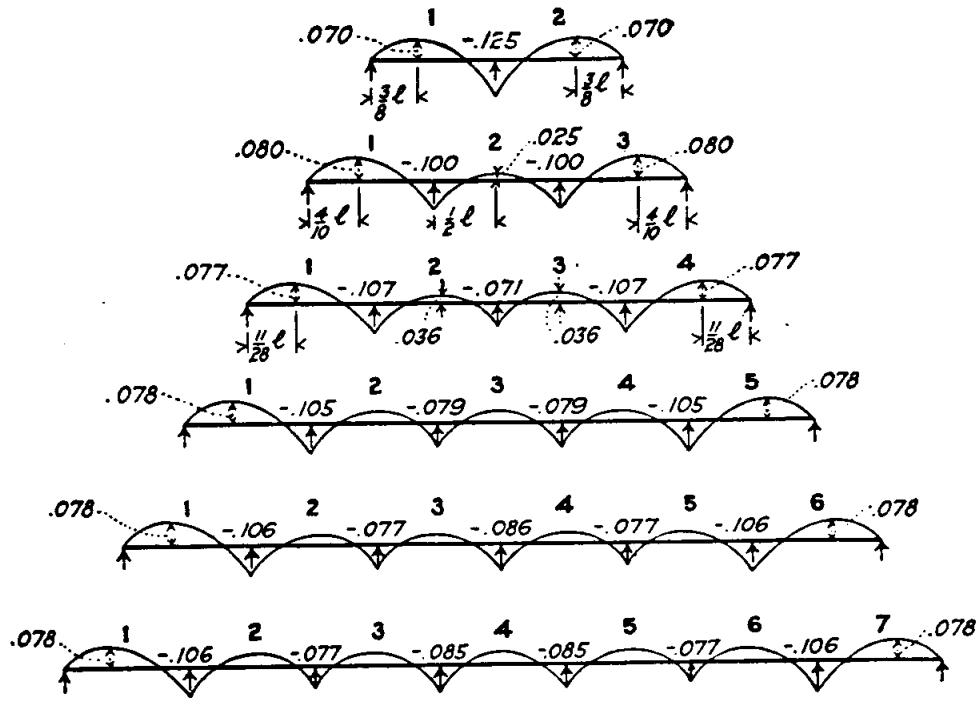
	$M_{12} = -M_{21} = +\frac{wL^2}{12}$		$M_{12} = +\frac{1}{20} wL^2$ $M_{21} = -\frac{1}{30} wL^2$		$M_{12} = \frac{P.b}{2L^2}(L^2 - b^2)$
	$M_{12} = +\frac{wL^2}{8}$		$M_{12} = +\frac{wL^2}{15}$		$M_{12} = -M_{21} = \frac{PL}{8}$
	$M_{12} = +\frac{ws^2}{12L^2}(6b^2 + 4bs + s^2)$ $M_{21} = -\frac{ws^3}{12L^2}(4b + s)$		$M_{21} = -\frac{7}{120} wL^2$		$M_{12} = \frac{3}{16} PL$
	$M_{12} = +\frac{ws^2}{8}(1 + \frac{b}{L})^2$		$M_{12} = +\frac{ws^2}{60}(10 - 10\frac{s}{L} + 3\frac{s^2}{L^2})$ $M_{21} = -\frac{ws^3}{60L}(5 - \frac{3s}{L})$		$M_{12} = -M_{21} = P\frac{a}{L}(L - a)$
	$M_{21} = -\frac{ws^2}{8}(2 - \frac{s^2}{L^2})$		$M_{12} = +\frac{ws^2}{120}(20 - 15\frac{s}{L} + 3\frac{s^2}{L^2})$		$M_{21} = P\frac{1.5a}{L}(L - a)$
	$M_{12} = +\frac{2wm}{L^2}[bL^2 - b^3 - \frac{m^2L}{3}(\frac{3b}{L} - 1)]$ $M_{21} = -\frac{2wm}{L^2}[aL^2 - a^3 - \frac{m^2L}{3}(\frac{3a}{L} - 1)]$		$M_{21} = -\frac{ws^2}{120}(10 - 3\frac{s^2}{L^2})$		$M_{12} = M_{21} = \frac{1}{12} PLn(1 - \frac{1}{n^2}$
			$M_{12} = -M_{21} = \frac{5}{96} W_m \cdot L^2$		$M_{12} = \frac{1}{8} PLn(1 - \frac{1}{n^2})$
	$M_{12} = +\frac{w}{8L^2}[2(c^2L^2 - b^2L^2) - c^4 + b^4]$		$M_{12} = \frac{5}{64} W_m L^2$		$M_{12} = -M_{21} = \frac{1}{12} PLn(1 + \frac{1}{2n^2}$
	$M_{21} = -\frac{w}{3L^2}[2(c^2L^2 - a^2L^2) - c^4 + a^4]$		$M_{12} = -M_{21} = \frac{EI\alpha\Delta t}{h}$		$M_{12} = \frac{1}{8} PLn(1 + \frac{1}{2n^2}$
	$M_{12} = -M_{21} = \frac{WS}{24L} \cdot (3L^2 - S^2)$		$M_{12} = 1.5\frac{EI\alpha\Delta t}{h}$		$M_{12} = -M\frac{b}{L}(2 - 3\frac{b}{L})$ $M_{21} = -M\frac{a}{L}(2 - 3\frac{a}{L})$
	$M_{12} = \frac{WS}{16L}(3L^2 - S^2)$		$M_{12} = +\frac{Pab^2}{L^2}$ $M_{21} = -\frac{Pa^2b}{L^2}$		$M_{12} = -\frac{1}{2}M(1 - 3\frac{b^2}{L^2}$

MOMENTS & REACTIONS OF CANTILEVERED CONTINUOUS BEAMS FOR 6 SPANS



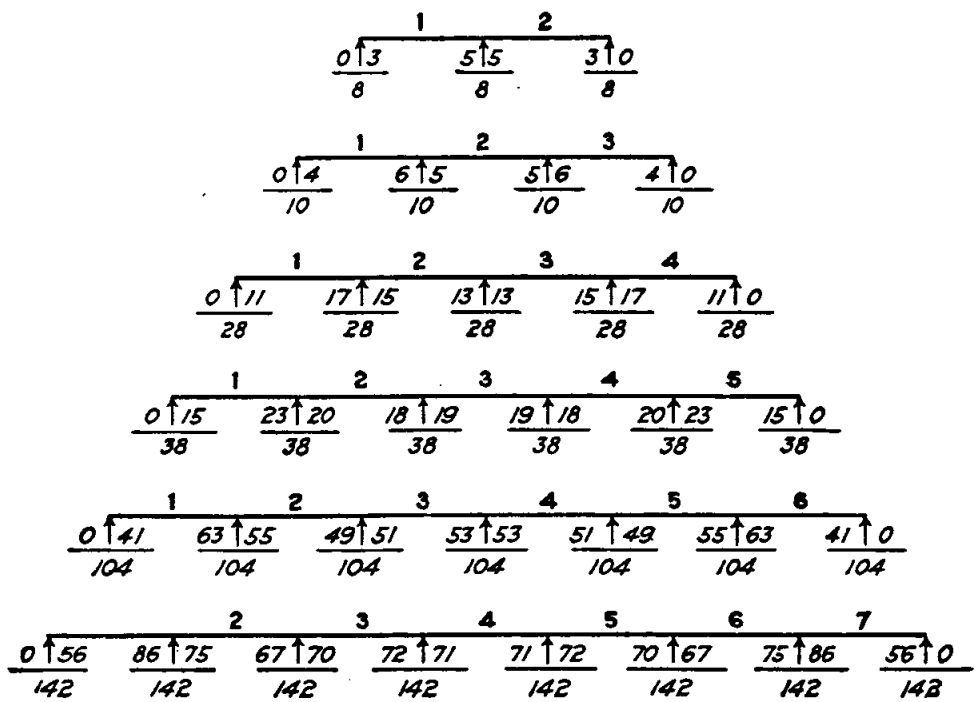
MOM.	2 - SPAN		3 - SPAN		4 - SPAN		5 - SPAN		6 - SPAN	
	EQUAL "P"	ONE "P"	EQUAL "P"	ONE "P"	EQUAL "P"	ONE "P"	EQUAL "P"	ONE "P"	EQUAL "P"	ONE "P"
M_1	$-Px$	$-Px$	$-Px$	$-Px$	$-Px$	$-Px$	$-Px$	$-Px$	$-Px$	$-Px$
M_2	$\frac{+Px}{2}$	$\frac{+Px}{4}$	$\frac{+Px}{5}$	$\frac{+4Px}{15}$	$\frac{+2Px}{7}$	$\frac{+15Px}{56}$	$\frac{+5Px}{19}$	$\frac{+56Px}{209}$	$\frac{+7Px}{26}$	$\frac{+209Px}{780}$
M_3	$-Px$	0	$\frac{+PX}{5}$	$\frac{-Px}{15}$	$\frac{-Px}{7}$	$\frac{-4Px}{56}$	$\frac{-Px}{19}$	$\frac{-15Px}{209}$	$\frac{-2Px}{26}$	$\frac{-56Px}{780}$
M_4	—	—	$-Px$	0	$\frac{+2Px}{7}$	$\frac{+1Px}{56}$	$\frac{-Px}{19}$	$\frac{+4Px}{209}$	$\frac{+Px}{26}$	$\frac{+15Px}{780}$
M_5	—	—	—	—	$-Px$	0	$\frac{+5Px}{19}$	$\frac{-Px}{209}$	$\frac{-2Px}{26}$	$\frac{-4Px}{780}$
M_6	—	—	—	—	—	—	$-Px$	0	$\frac{+7Px}{26}$	$\frac{+Px}{780}$
M_7	—	—	—	—	—	—	—	—	$-Px$	0
REAC.										
R_1	$P+\frac{3Px}{2L}$	$P+\frac{5Px}{4L}$	$P+\frac{6Px}{5L}$	$P+\frac{19Px}{15L}$	$P+\frac{9Px}{7L}$	$P+\frac{71Px}{56L}$	$P+\frac{24Px}{19L}$	$P+\frac{265Px}{209L}$	$P+\frac{33Px}{26L}$	$P+\frac{989Px}{780L}$
R_2	$\frac{-3Px}{L}$	$\frac{-3Px}{2L}$	$\frac{-6Px}{5L}$	$\frac{-24Px}{15L}$	$\frac{-12Px}{7L}$	$\frac{-90Px}{56L}$	$\frac{-30Px}{19L}$	$\frac{-336Px}{209L}$	$\frac{-42Px}{26L}$	$\frac{-1245Px}{780L}$
R_3	R_1	$\frac{Px}{4L}$	R_2	$\frac{+6Px}{15L}$	$\frac{+6Px}{7L}$	$\frac{+24Px}{56L}$	$\frac{+6Px}{19L}$	$\frac{+90Px}{209L}$	$\frac{+12Px}{26L}$	$\frac{+336Px}{780L}$
R_4	—	—	R_1	$\frac{-Px}{15L}$	R_2	$\frac{-6Px}{56L}$	R_3	$\frac{-24Px}{209L}$	$\frac{-6Px}{26L}$	$\frac{-90Px}{780L}$
R_5	—	—	—	—	R_1	$\frac{+Px}{56L}$	R_2	$\frac{+6Px}{209L}$	R_3	$\frac{+24Px}{780L}$
R_6	—	—	—	—	—	—	R_1	$\frac{-Px}{209L}$	R_2	$\frac{-6Px}{780L}$
R_7	—	—	—	—	—	—	—	—	R_1	$\frac{+Px}{780L}$

MOMENT COEFFICIENTS



Moments in continuous beams; supported ends; uniform load on all spans; spans all *equal*.
Coefficients of (wl^2).

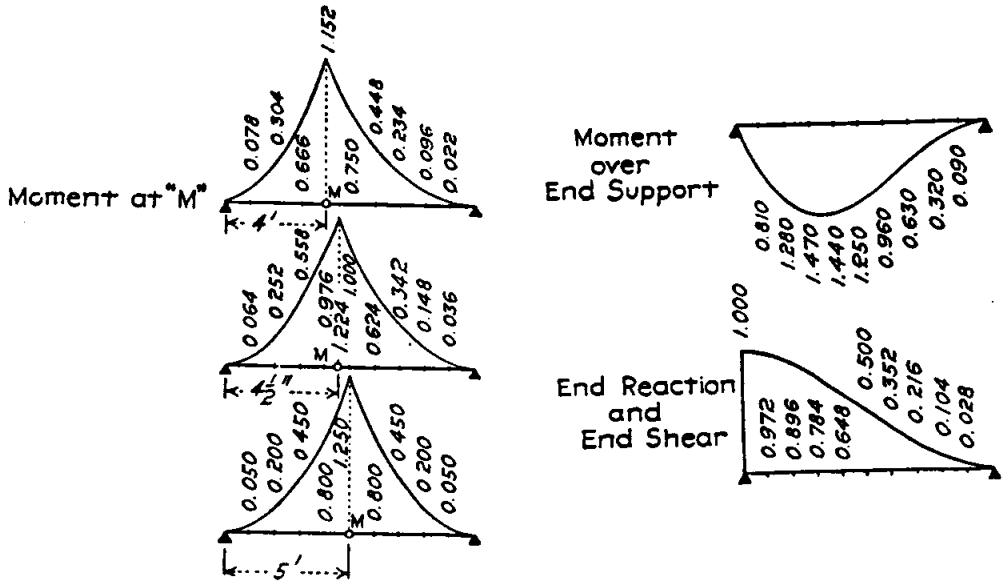
SHEAR COEFFICIENTS



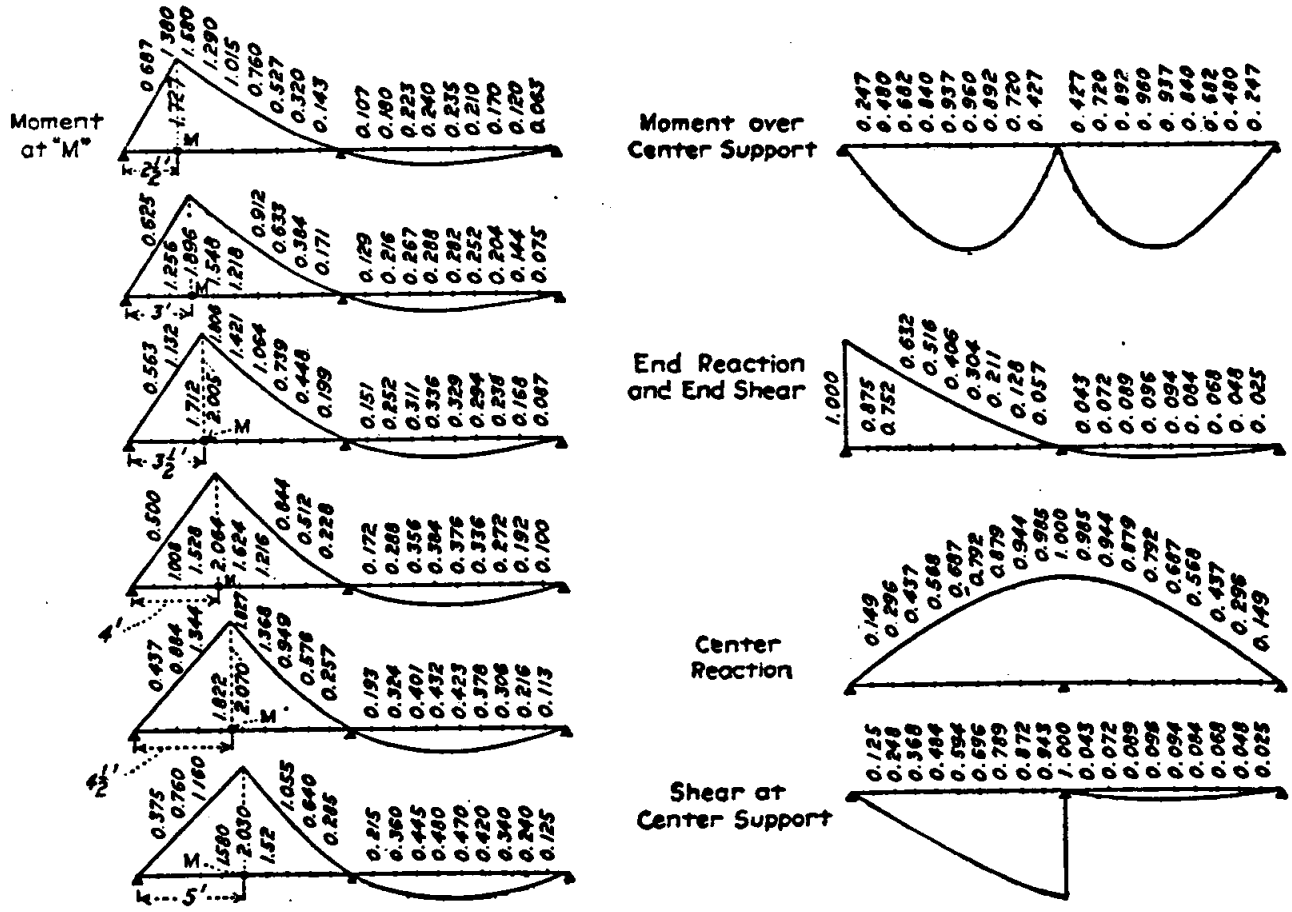
Shears in continuous beams; supported ends; uniform loads on all spans; spans all *equal*.
Coefficients of (wl).

INFLUENCE COEFFICIENTS

1 - SPAN FIXED ENDS
2 - SPANS SUPPORTED ENDS



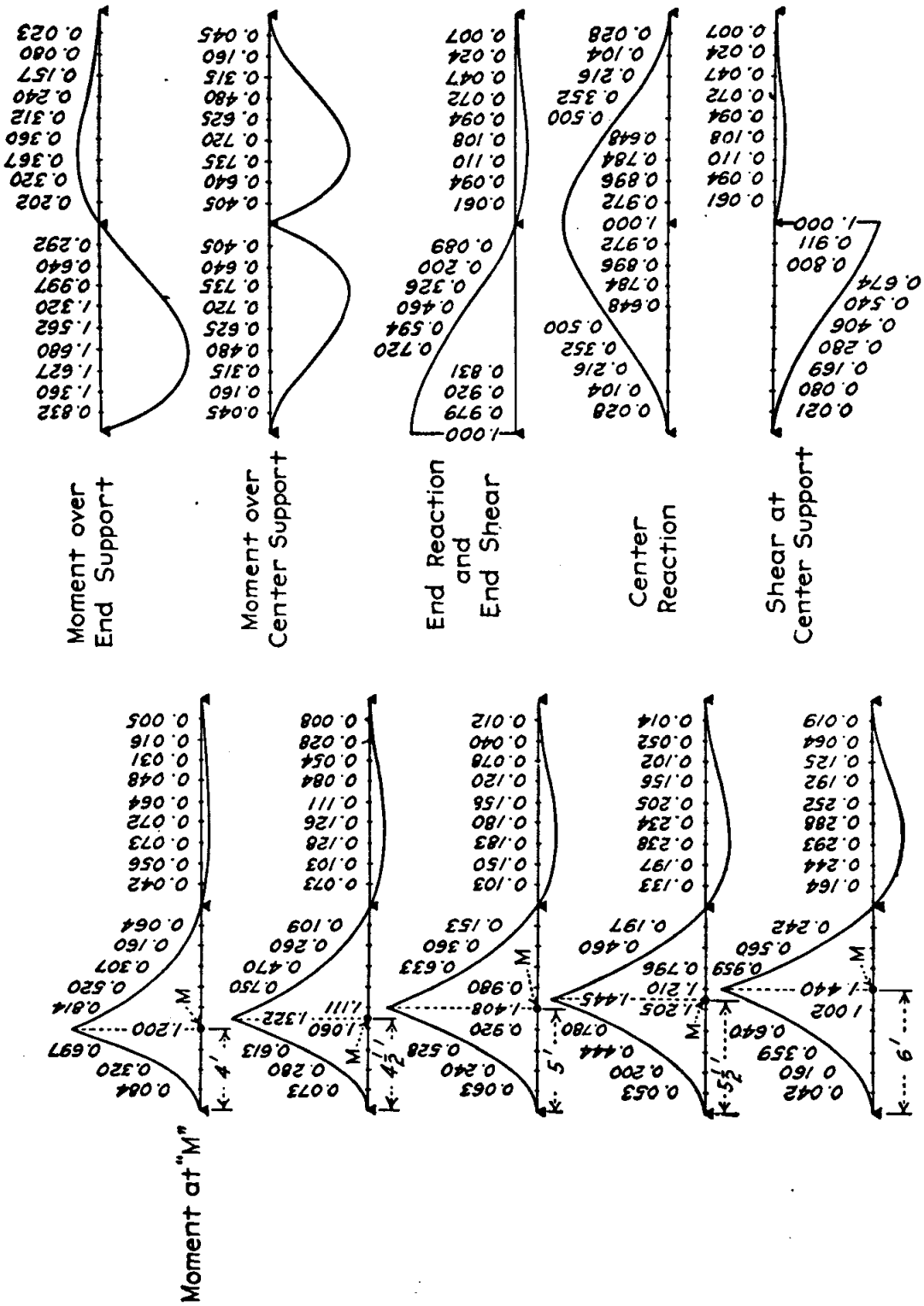
Influence lines for one span, fixed ends. (Spans, 10 ft. Load, unity.)



Influence lines for two equal spans, supported ends. (Spans, 10 ft. Load, unity.)

INFLUENCE COEFFICIENT

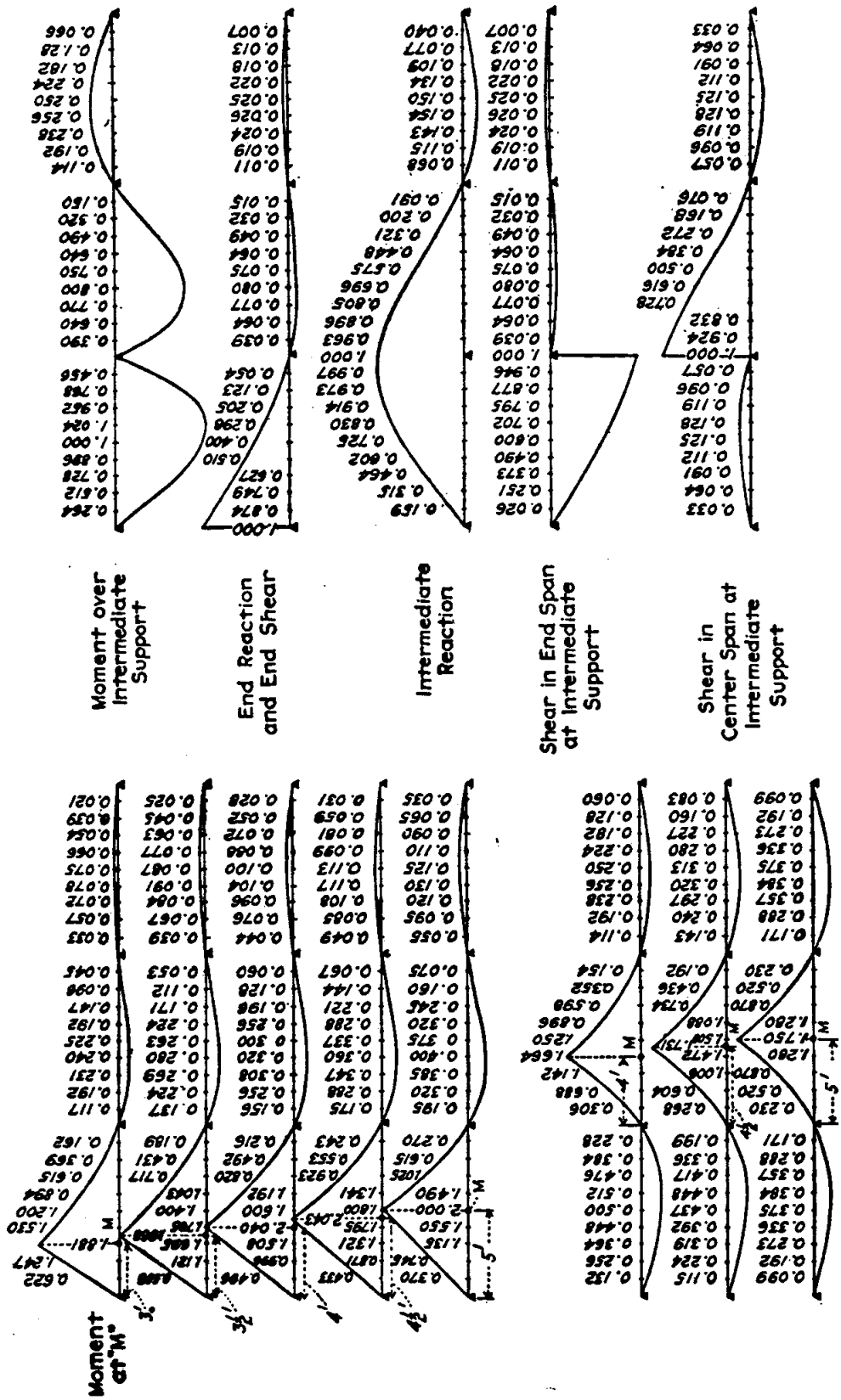
2 - SPANS FIXED ENDS



Influence lines for two equal spans, fixed ends. (Spans, 10 ft. Load, unity.)

INFLUENCE COEFFICIENTS

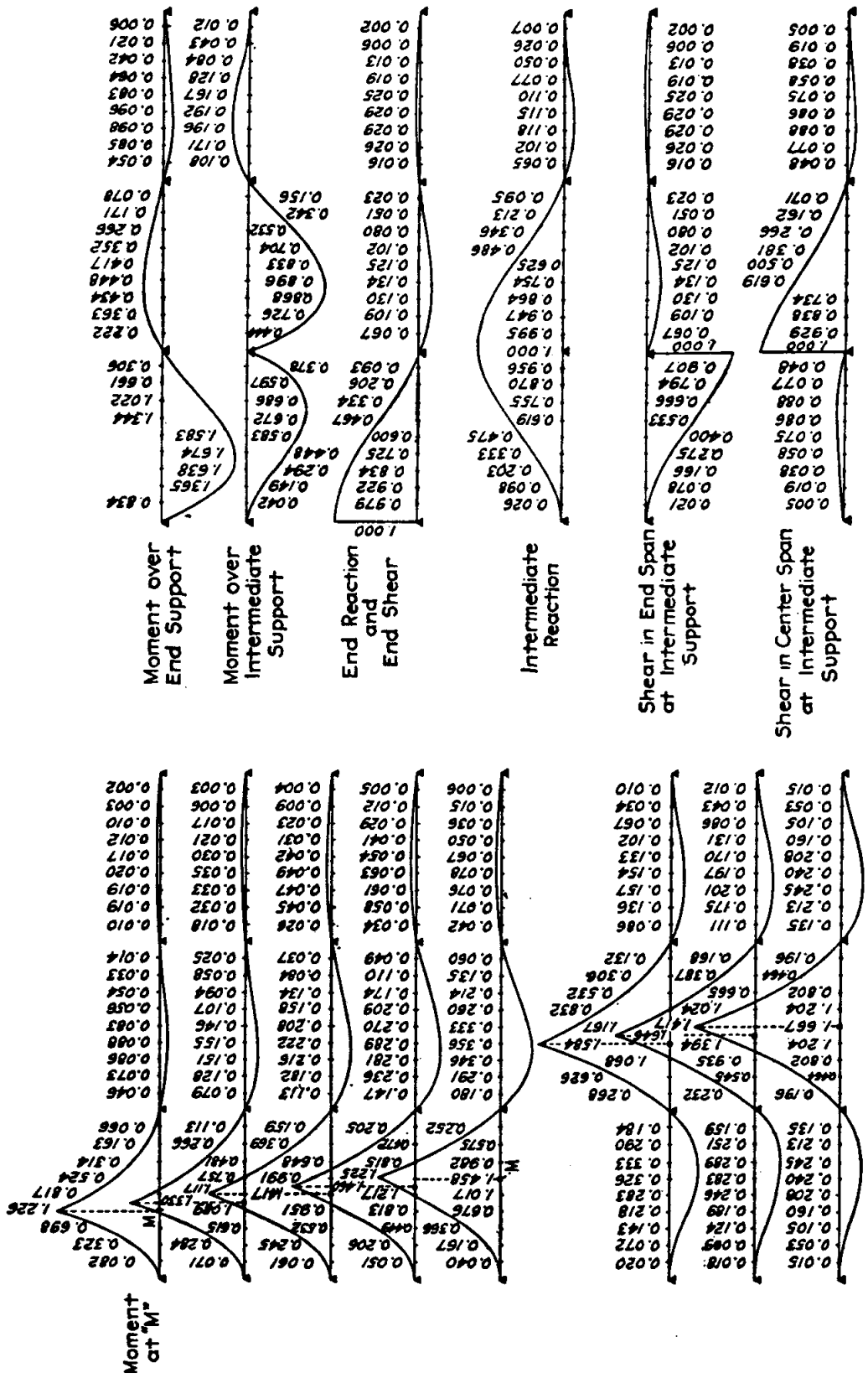
3 - SPANS SUPPORTED ENDS



Influence lines for three equal spans, supported ends. (Spans, 10 ft. Load, unity.)

INFLUENCE COEFFICIENTS

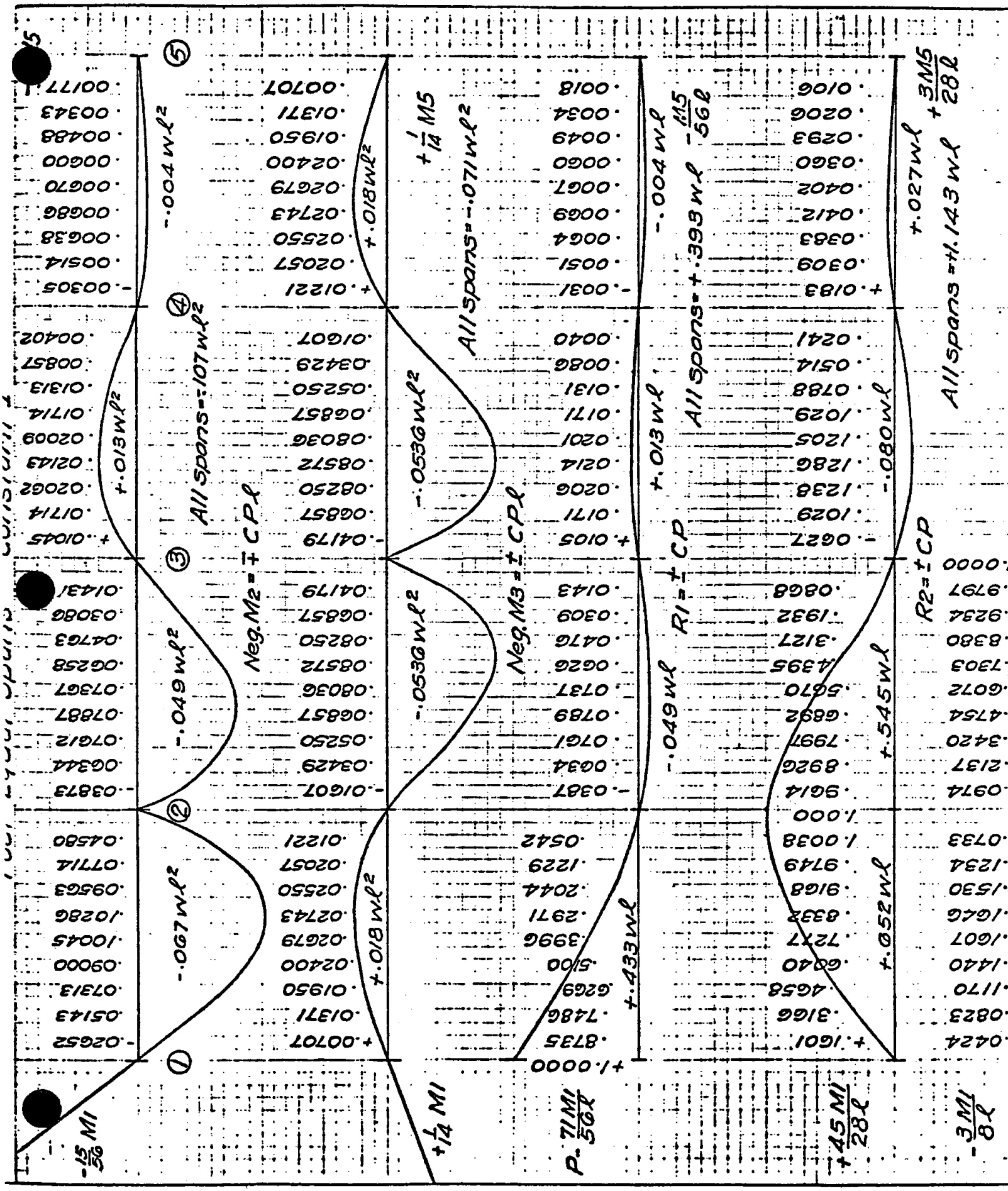
3 - SPANS FIXED ENDS



Influence lines for three equal spans, fixed ends. (Spans, 10 ft. Load, unity.)

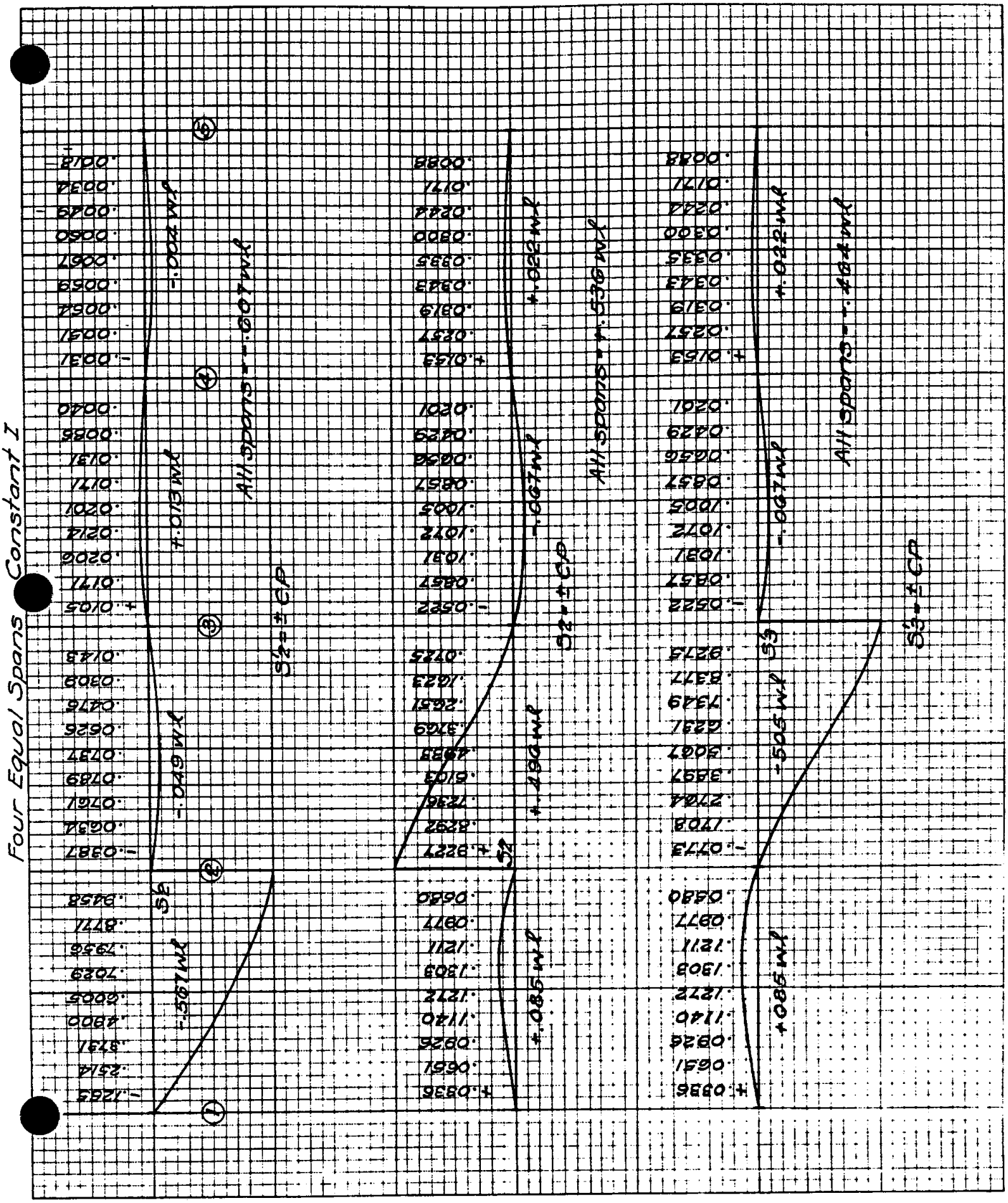
INFLUENCE COEFFICIENTS

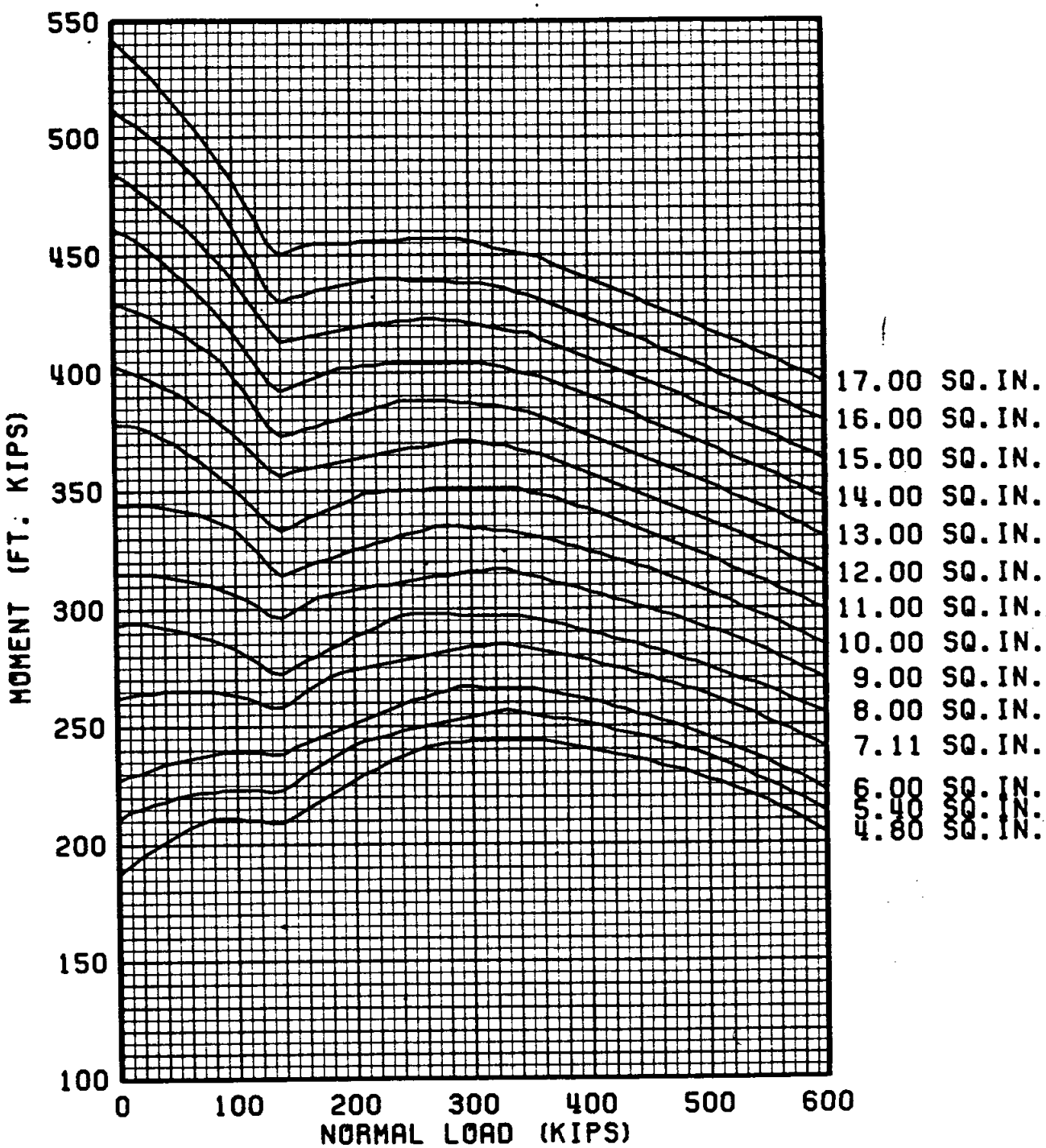
4 - SPANS MOMENT & REACTION



INFLUENCE COEFFICIENTS

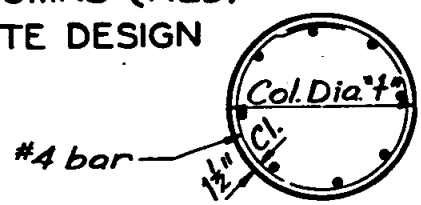
4 - SPANS SHEAR



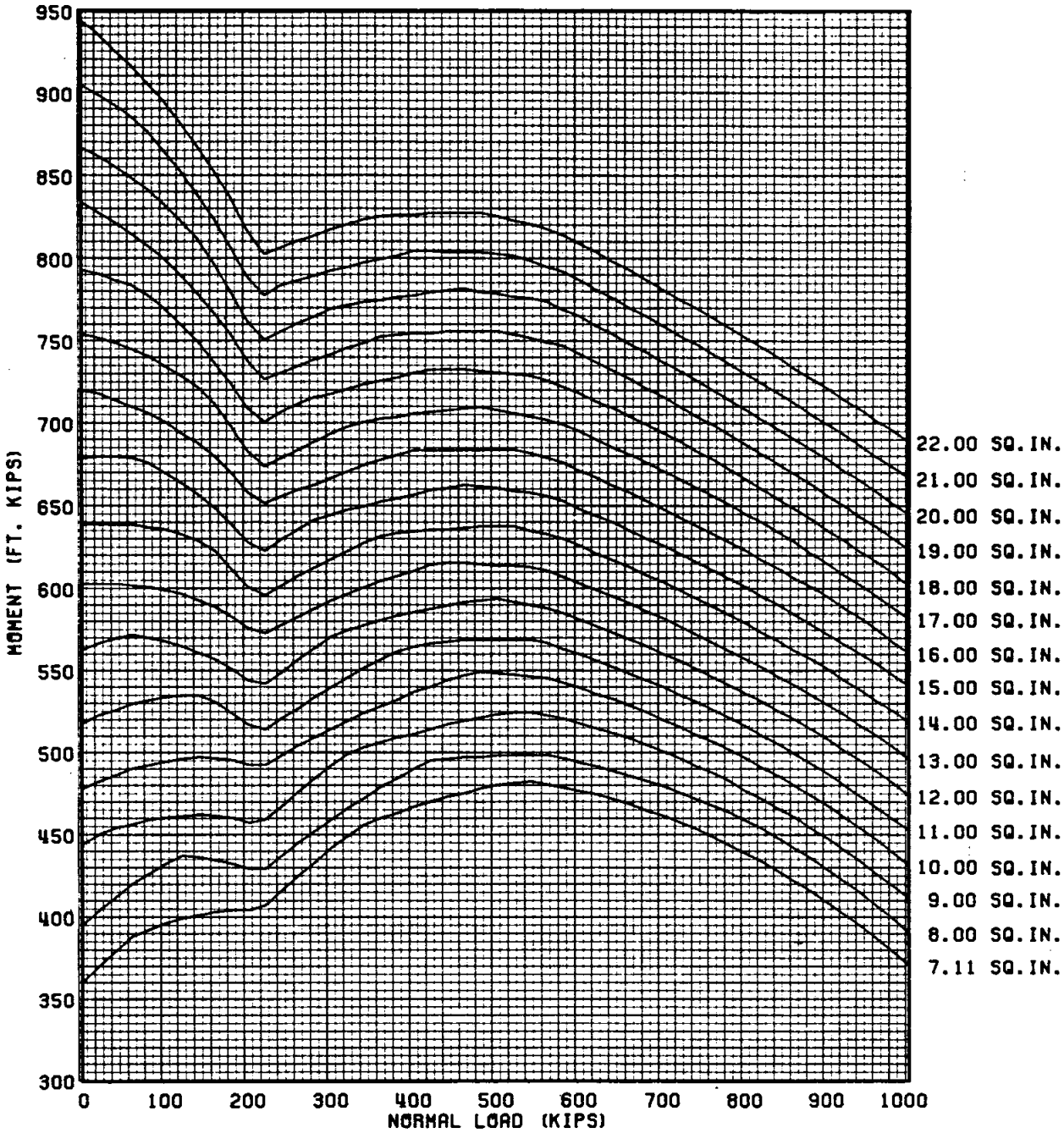


STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN

t = 24" ϕ_c = 0.70
$f'c$ = 3,000 ϕ_b = 0.90
f_y = 60,000

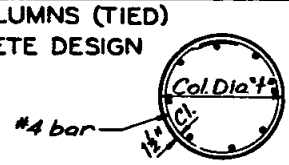


NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND, WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.

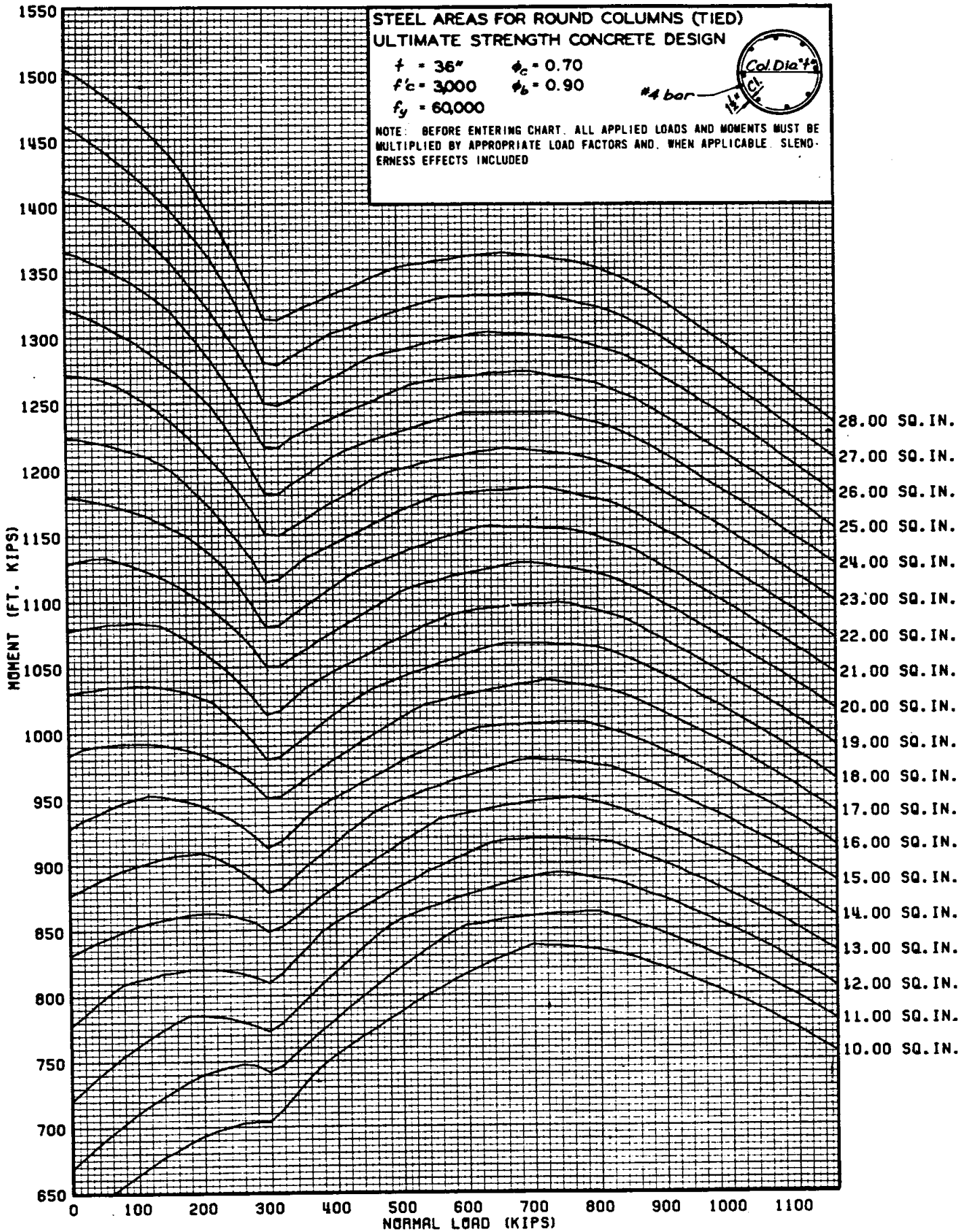


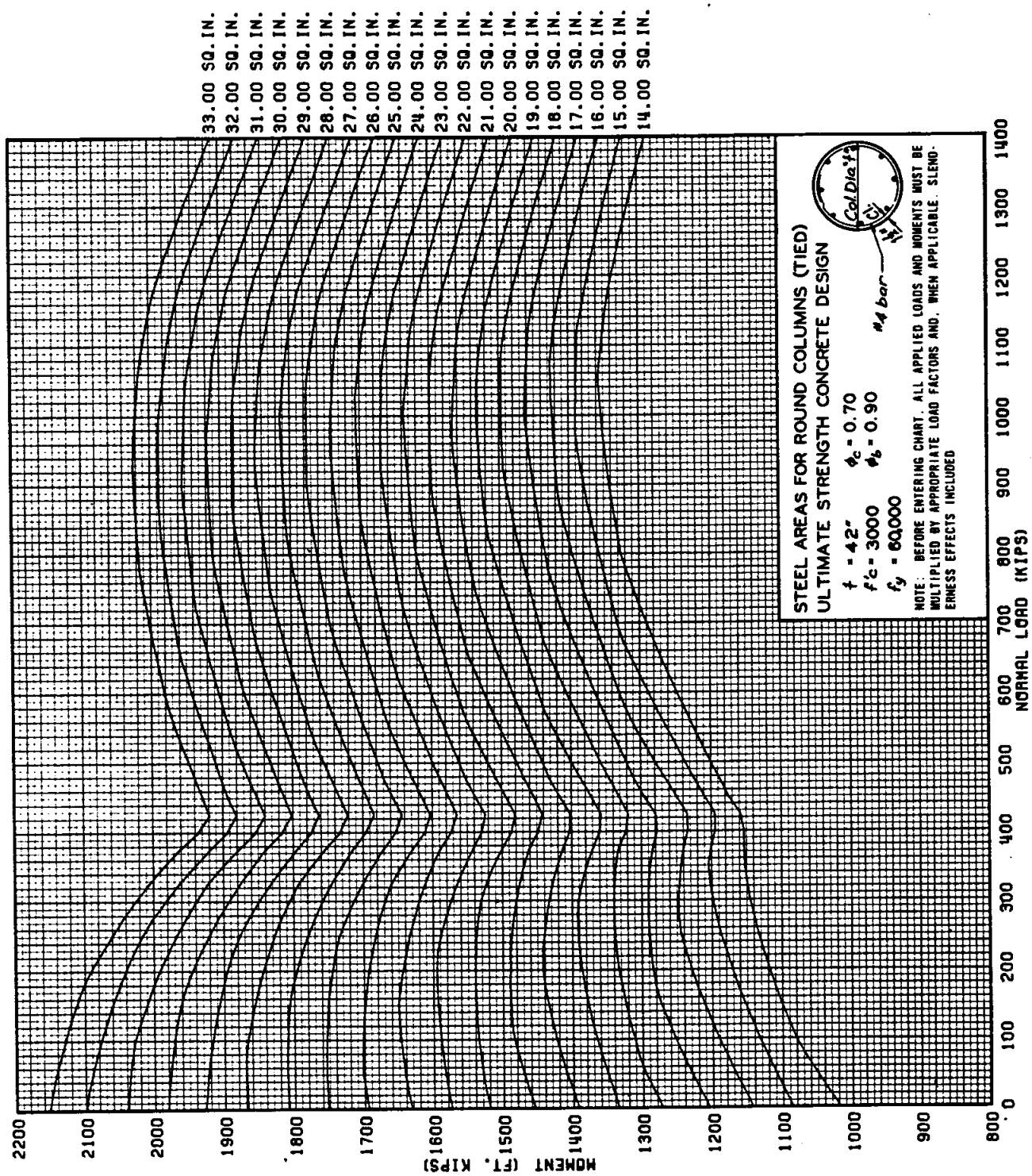
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN

t = 30" ϕ_c = 0.70
$f'c$ = 3000 ϕ_b = 0.90
f_y = 60,000

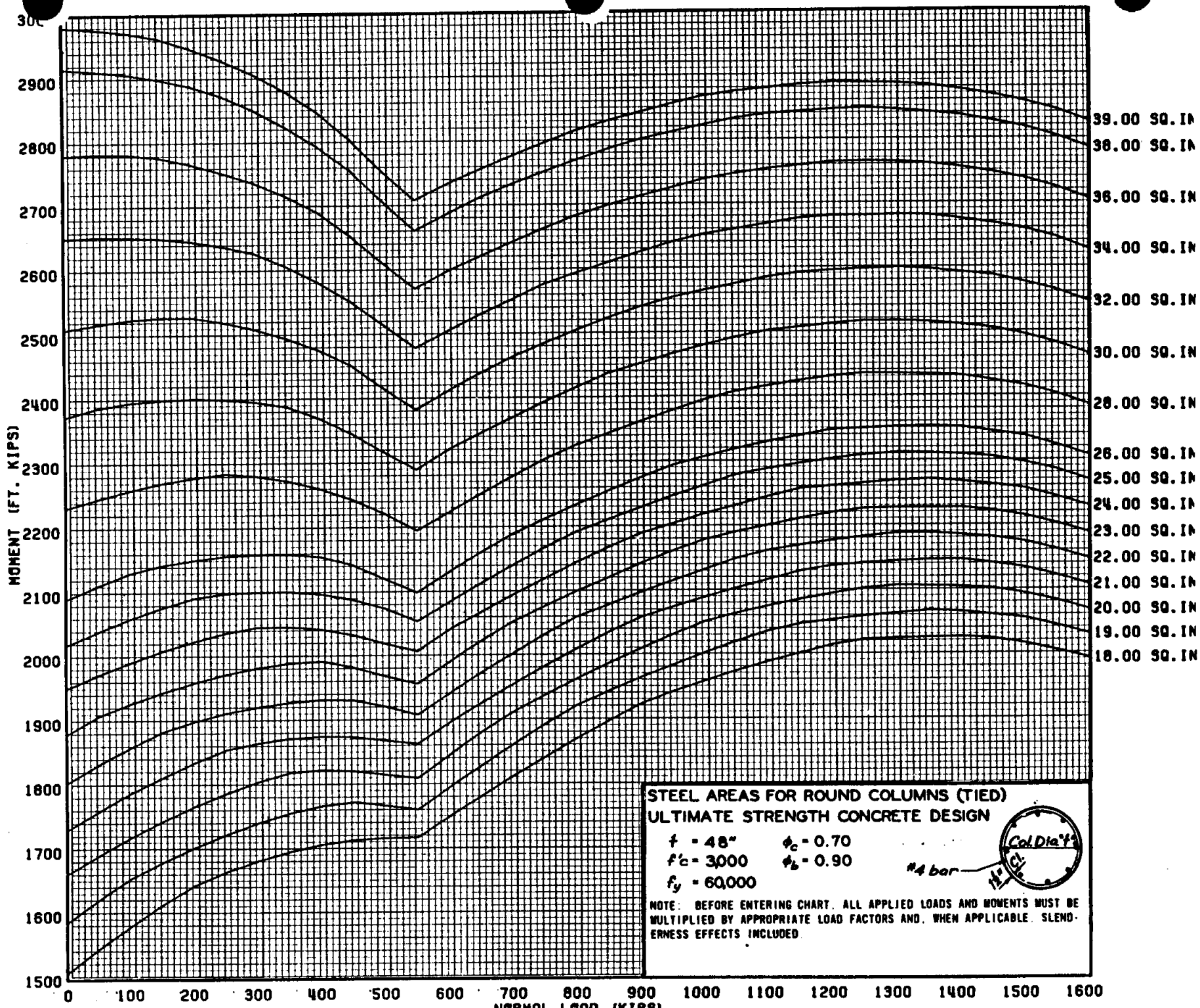


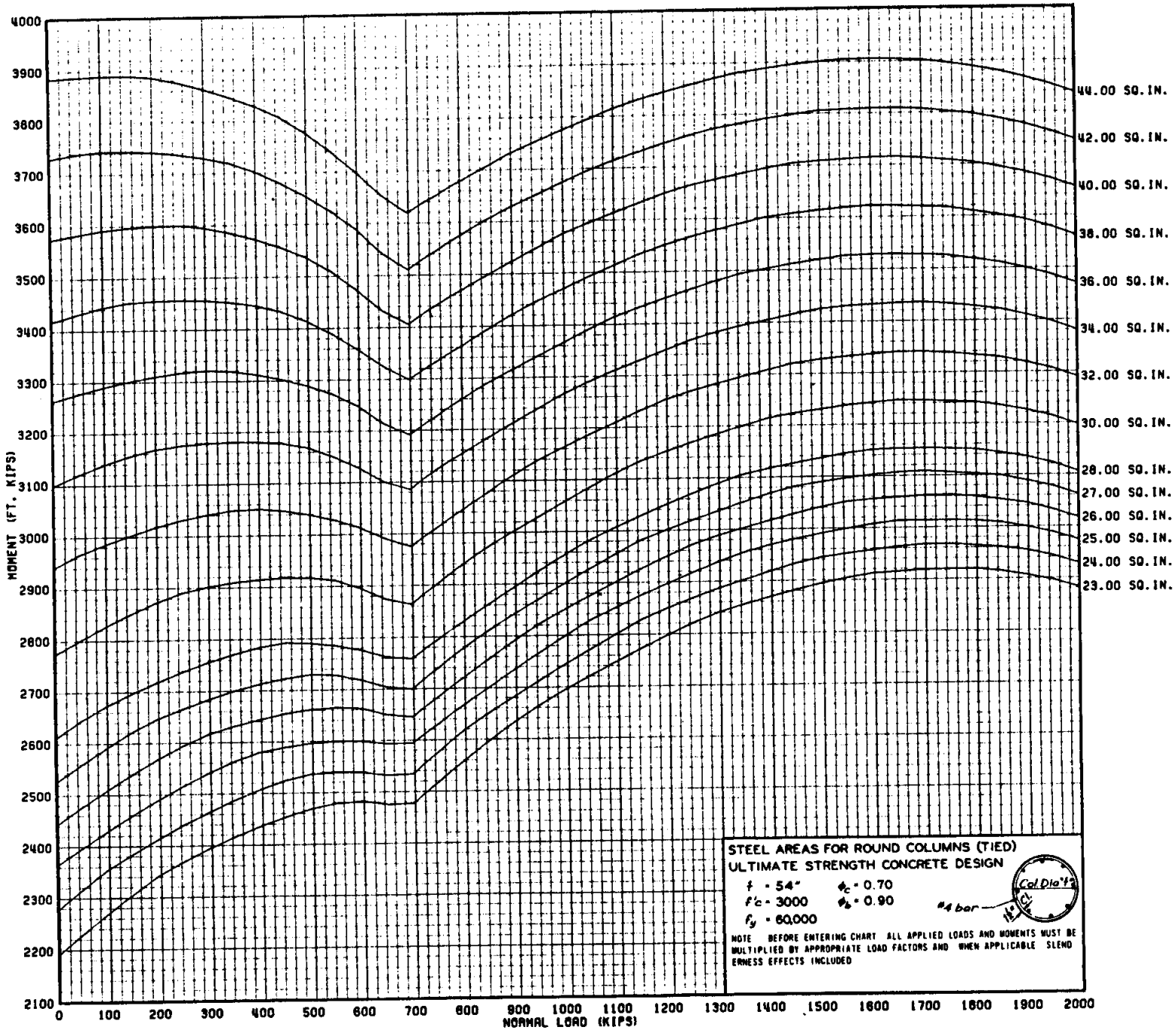
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND, WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.

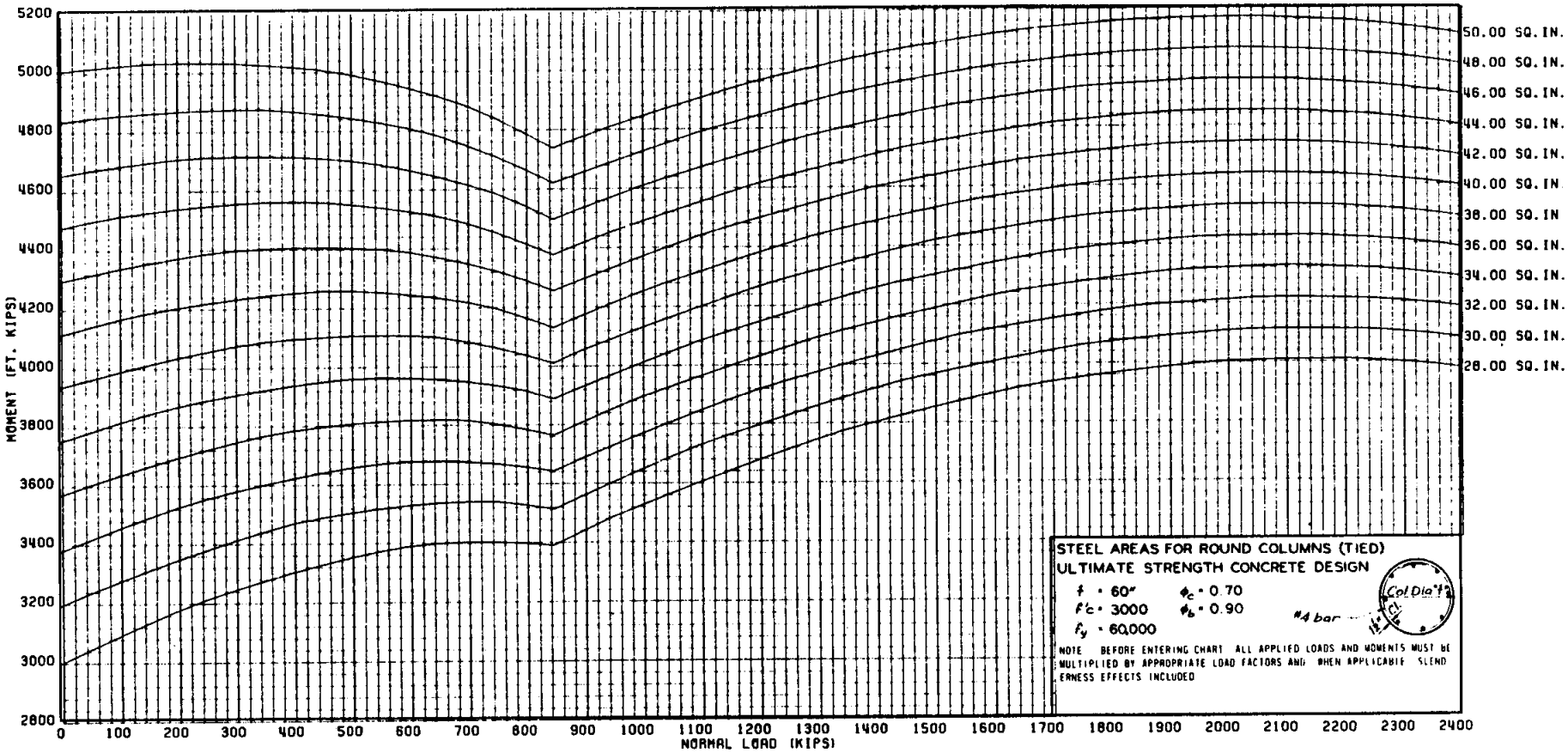

STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
t = 36"
f'c = 3,000
fy = 60,000
φc = 0.70
φb = 0.90
#4 bar
Col. Dia "t"
Cl.
1½"
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND, WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED
MOMENT (FT. KIPS)
1550
1500
1450
1400
1350
1300
1250
1200
1150
1100
1050
1000
950
900
850
800
750
700
650
0
100
200
300
400
500
600
700
800
900
1000
1100
NORMAL LOAD (KIPS)
28.00 SQ. IN.
27.00 SQ. IN.
26.00 SQ. IN.
25.00 SQ. IN.
24.00 SQ. IN.
23.00 SQ. IN.
22.00 SQ. IN.
21.00 SQ. IN.
20.00 SQ. IN.
19.00 SQ. IN.
18.00 SQ. IN.
17.00 SQ. IN.
16.00 SQ. IN.
15.00 SQ. IN.
14.00 SQ. IN.
13.00 SQ. IN.
12.00 SQ. IN.
11.00 SQ. IN.
10.00 SQ. IN.

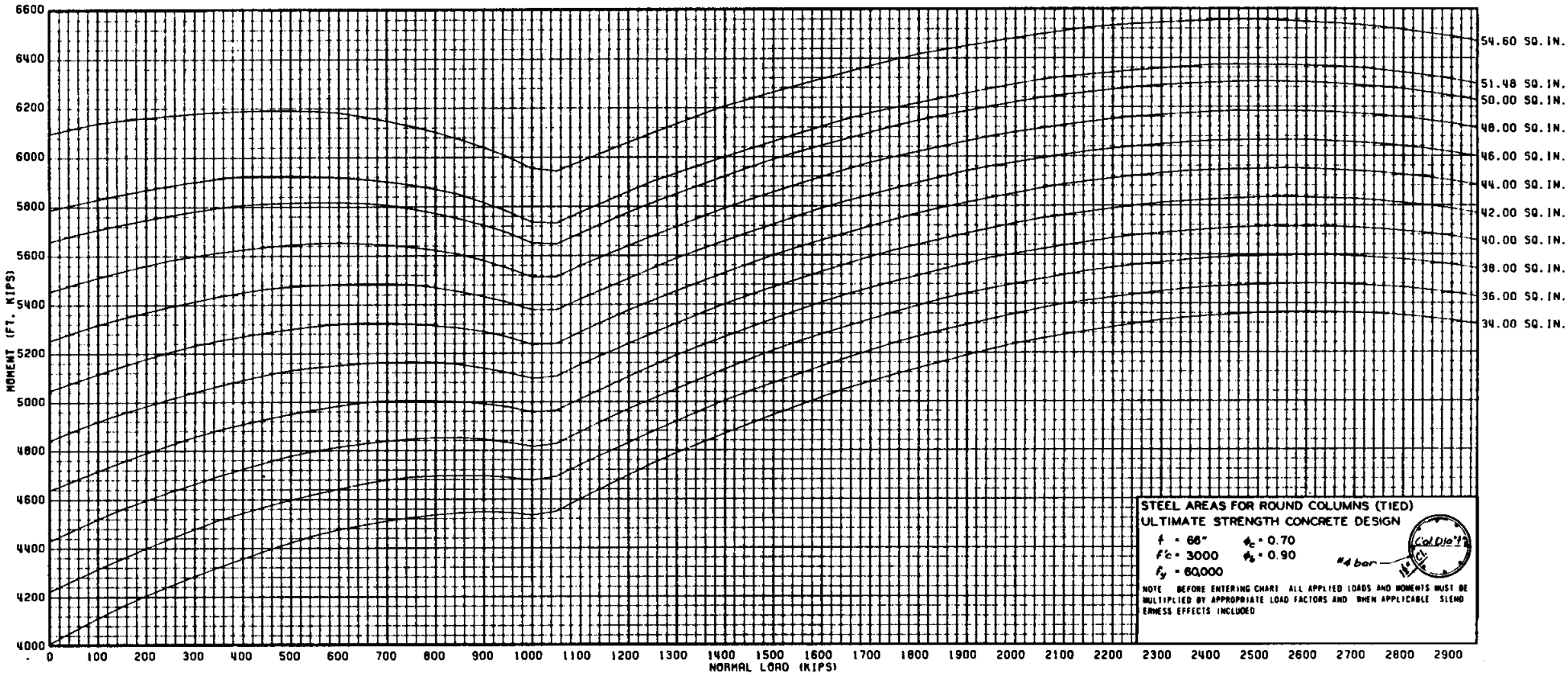


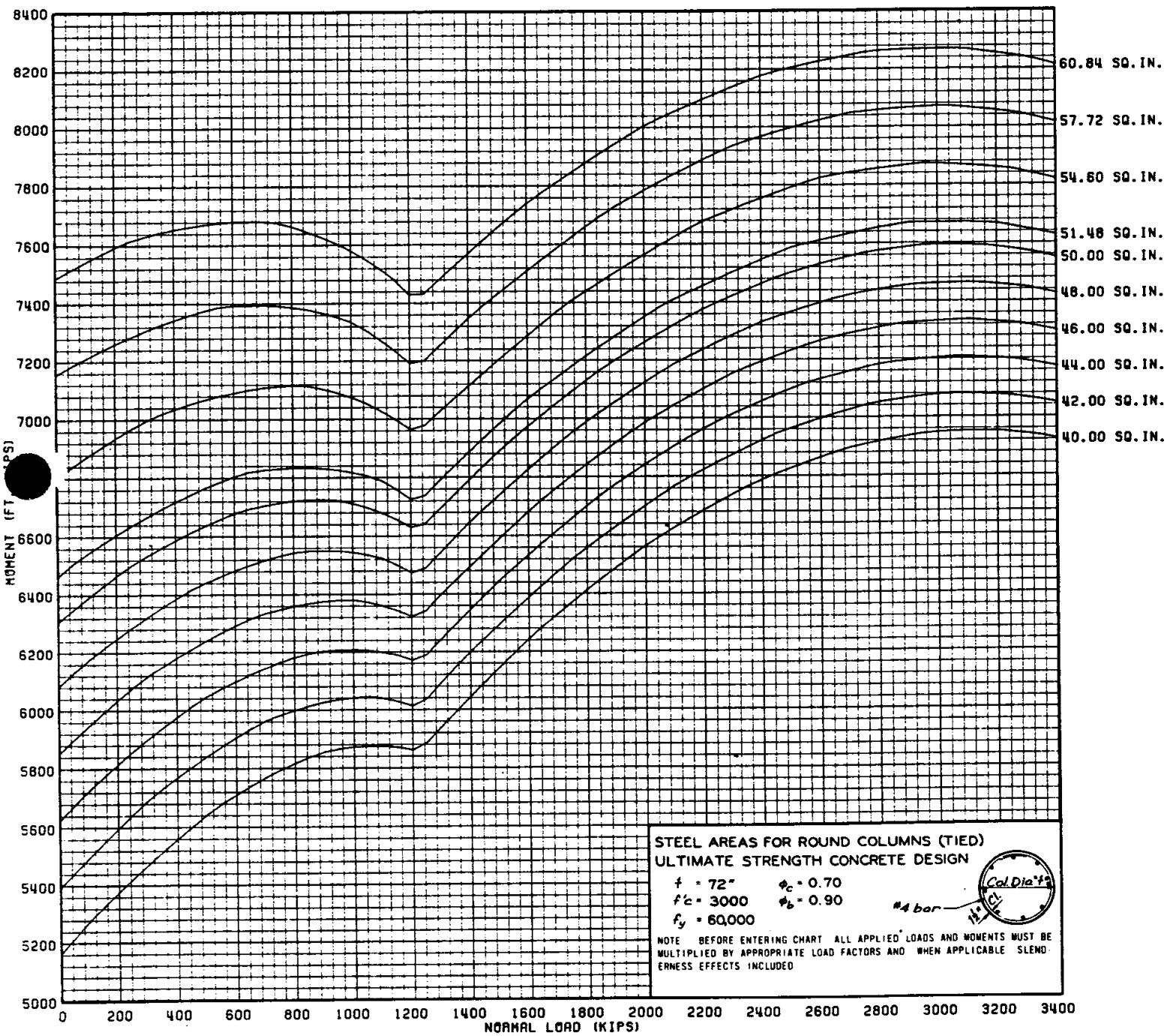
33.00 SQ.IN.
32.00 SQ.IN.
31.00 SQ.IN.
30.00 SQ.IN.
29.00 SQ.IN.
28.00 SQ.IN.
27.00 SQ.IN.
26.00 SQ.IN.
25.00 SQ.IN.
24.00 SQ.IN.
23.00 SQ.IN.
22.00 SQ.IN.
21.00 SQ.IN.
20.00 SQ.IN.
19.00 SQ.IN.
18.00 SQ.IN.
17.00 SQ.IN.
16.00 SQ.IN.
15.00 SQ.IN.
14.00 SQ.IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
f = 42"
f'c = 3000
fy = 60,000
φc = 0.70
φb = 0.90
#4 bar
Col. Dia. f
Cl.
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND, WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED
NORMAL LOAD (KIPS)
MOMENT (FT. KIPS)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200


MOMENT (FT. KIPS)
NORMAL LOAD (KIPS)
39.00 SQ.IN
38.00 SQ.IN
36.00 SQ.IN
34.00 SQ.IN
32.00 SQ.IN
30.00 SQ.IN
28.00 SQ.IN
26.00 SQ.IN
25.00 SQ.IN
24.00 SQ.IN
23.00 SQ.IN
22.00 SQ.IN
21.00 SQ.IN
20.00 SQ.IN
19.00 SQ.IN
18.00 SQ.IN
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
t = 48"
f'c = 3,000
fy = 60,000
φc = 0.70
φb = 0.90
#4 bar
Col. Dia "t"
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND, WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED

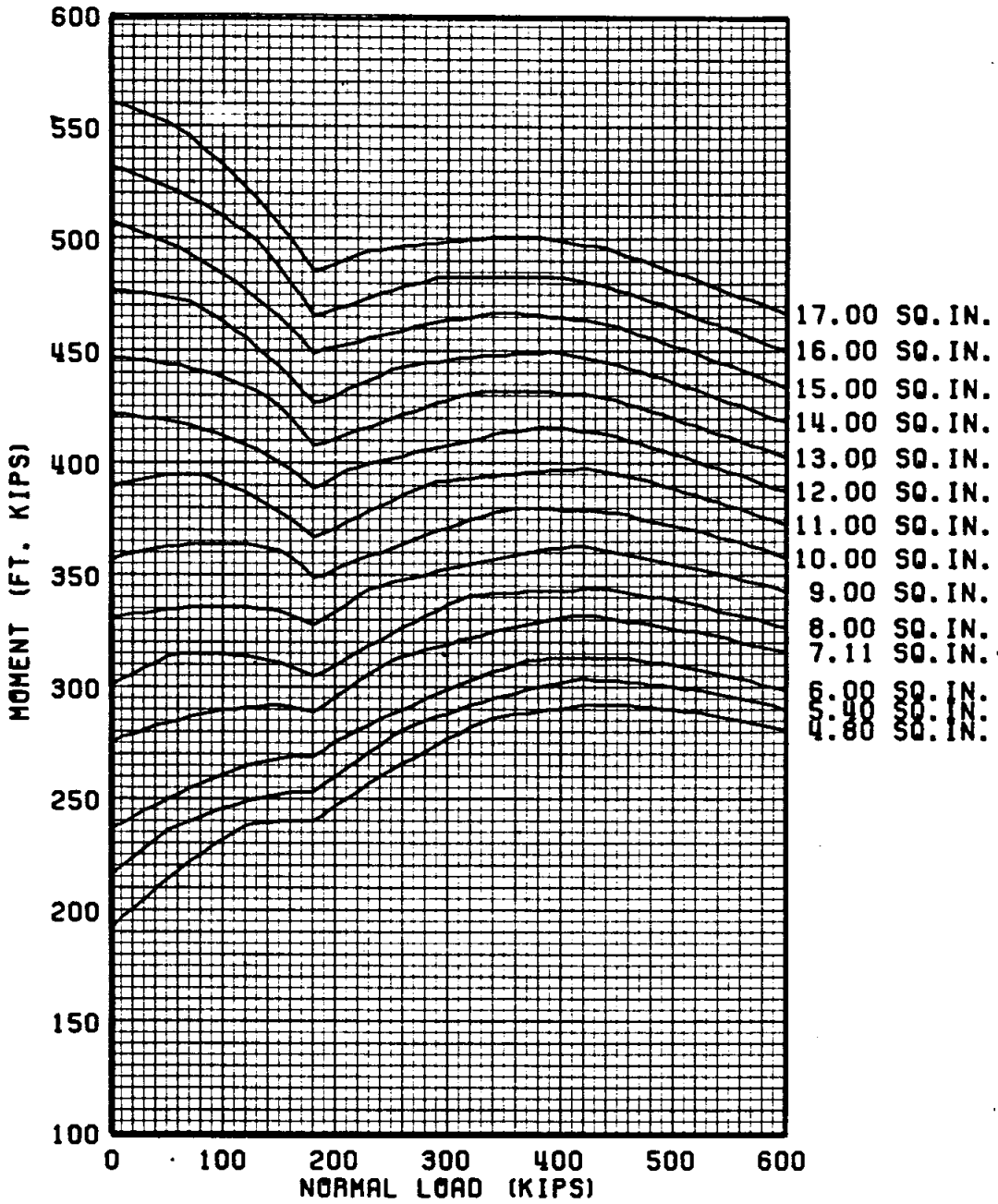

MOMENT (FT. KIPS)
4000
3900
3800
3700
3600
3500
3400
3300
3200
3100
3000
2900
2800
2700
2600
2500
2400
2300
2200
2100
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
NORMAL LOAD (KIPS)
44.00 SQ. IN.
42.00 SQ. IN.
40.00 SQ. IN.
38.00 SQ. IN.
36.00 SQ. IN.
34.00 SQ. IN.
32.00 SQ. IN.
30.00 SQ. IN.
28.00 SQ. IN.
27.00 SQ. IN.
26.00 SQ. IN.
25.00 SQ. IN.
24.00 SQ. IN.
23.00 SQ. IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
t = 54"
f'c = 3000
fy = 60,000
φc = 0.70
φb = 0.90
#4 bar
Col Dia"t"
NOTE BEFORE ENTERING CHART ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE SLENDERNESS EFFECTS INCLUDED


MOMENT (FT. KIPS)
5200
5000
4800
4600
4400
4200
4000
3800
3600
3400
3200
3000
2800
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
NORMAL LOAD (KIPS)
50.00 SQ. IN.
48.00 SQ. IN.
46.00 SQ. IN.
44.00 SQ. IN.
42.00 SQ. IN.
40.00 SQ. IN
38.00 SQ. IN
36.00 SQ. IN.
34.00 SQ. IN.
32.00 SQ. IN.
30.00 SQ. IN.
28.00 SQ. IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
f = 60"
f'c = 3000
fy = 60,000
φc = 0.70
φb = 0.90
#4 bar
Col Dia "f"
NOTE BEFORE ENTERING CHART ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE SLENDERNESS EFFECTS INCLUDED


6600
6400
6200
6000
5800
5600
5400
5200
5000
4800
4600
4400
4200
4000
MOMENT (FT. KIPS)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
NORMAL LOAD (KIPS)
54.60 SQ. IN.
51.48 SQ. IN.
50.00 SQ. IN.
48.00 SQ. IN.
46.00 SQ. IN.
44.00 SQ. IN.
42.00 SQ. IN.
40.00 SQ. IN.
38.00 SQ. IN.
36.00 SQ. IN.
34.00 SQ. IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
f = 66"
f'c = 3000
fy = 60,000
φc = 0.70
φb = 0.90
#4 bar
Col Dia "f"
NOTE BEFORE ENTERING CHART ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE SLENDERNESS EFFECTS INCLUDED

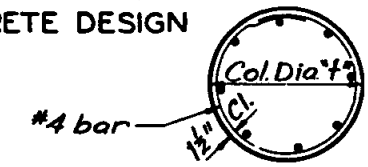


8400
8200
8000
7800
7600
7400
7200
7000
6600
6400
6200
6000
5800
5600
5400
5200
5000
MOMENT (FT
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
NORMAL LOAD (KIPS)
60.84 SQ.IN.
57.72 SQ.IN.
54.60 SQ.IN.
51.48 SQ.IN.
50.00 SQ.IN.
48.00 SQ.IN.
46.00 SQ.IN.
44.00 SQ.IN.
42.00 SQ.IN.
40.00 SQ.IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
f = 72"
f'c = 3000
fy = 60,000
φc = 0.70
φb = 0.90
#4 bar
Col. Dia. f
CL
NOTE BEFORE ENTERING CHART ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE SLENDERNESS EFFECTS INCLUDED

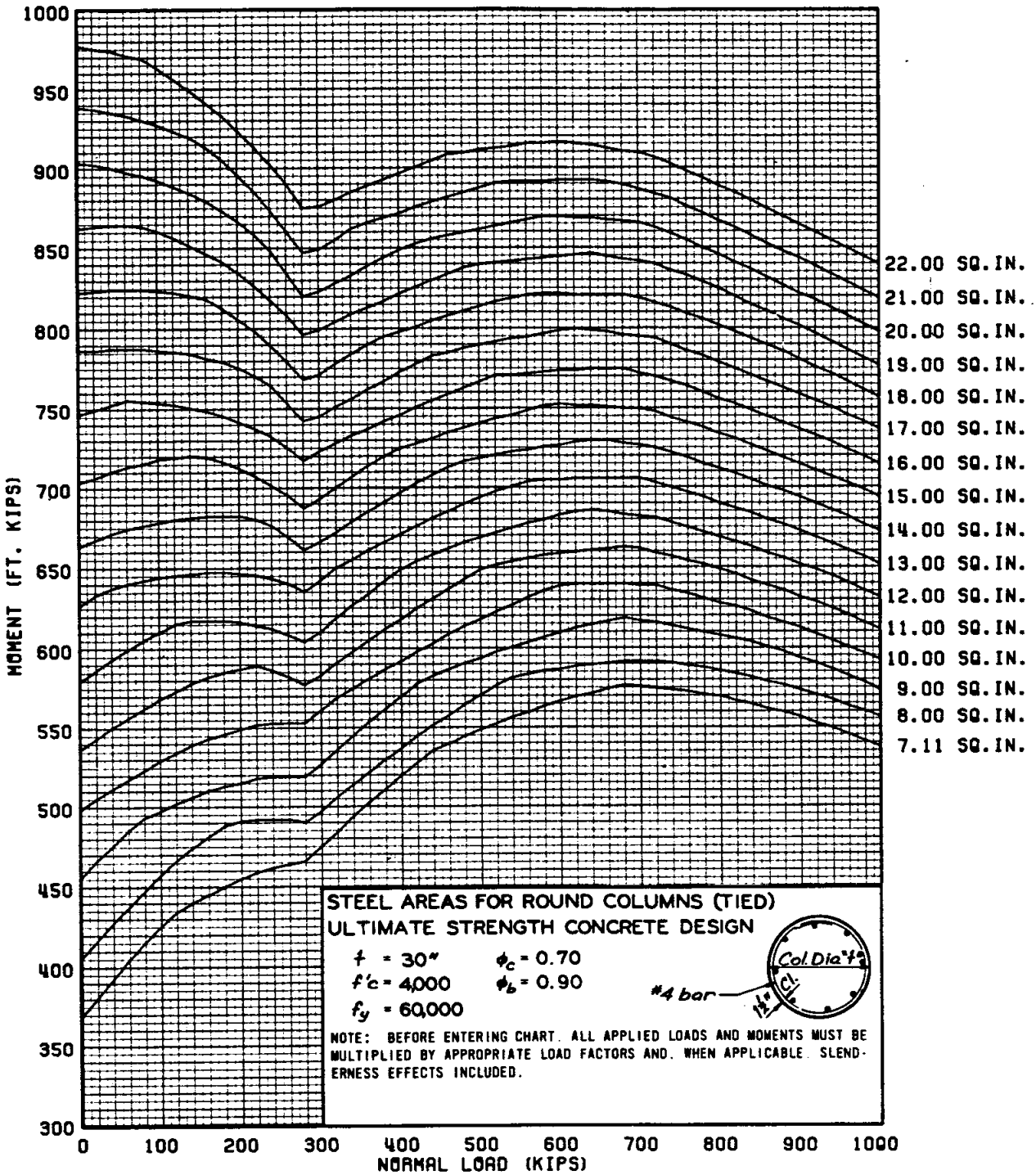


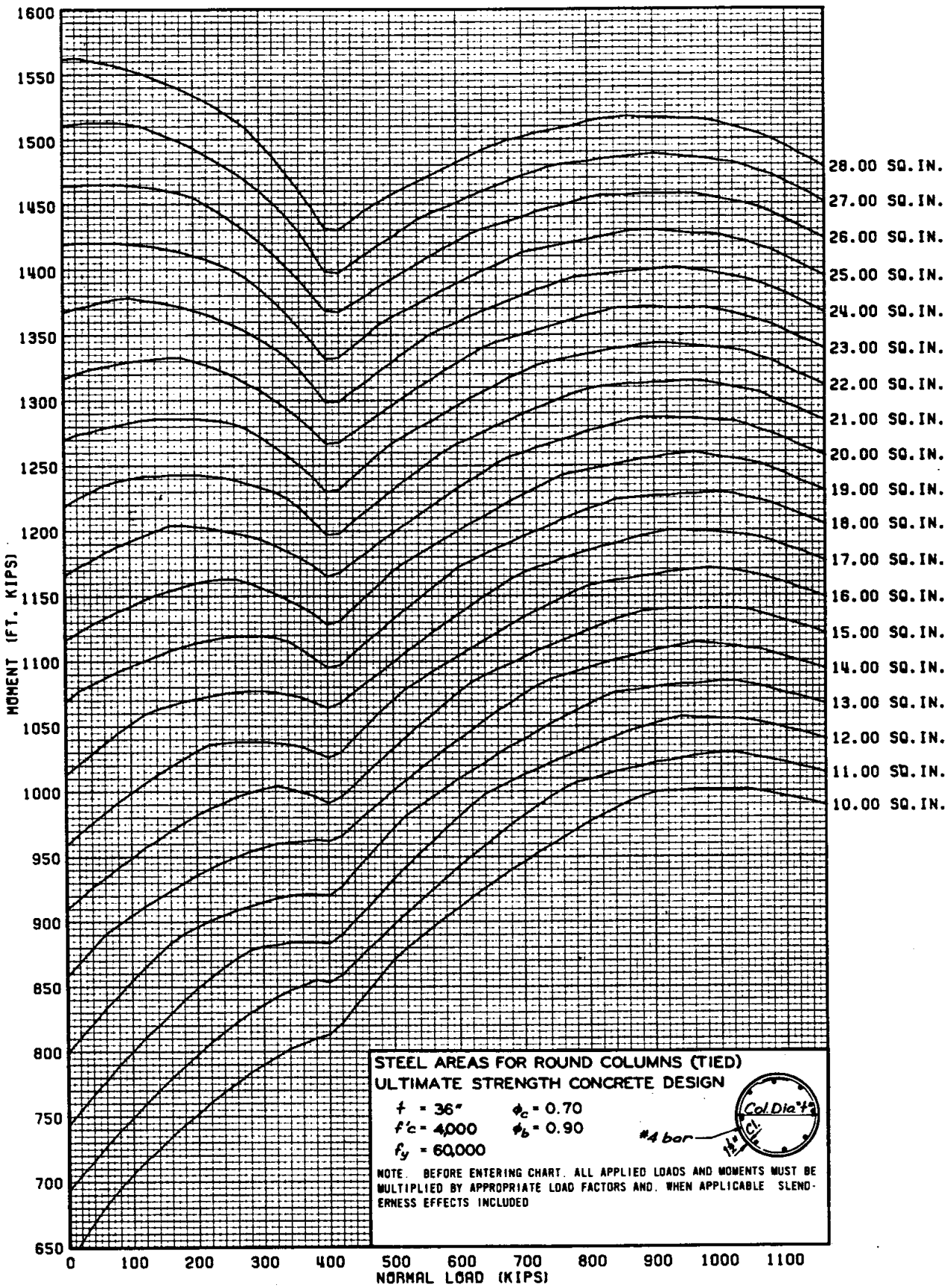
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN

t = 24" ϕ_c = 0.70
$f'c$ = 4,000 ϕ_b = 0.90
f_y = 60,000

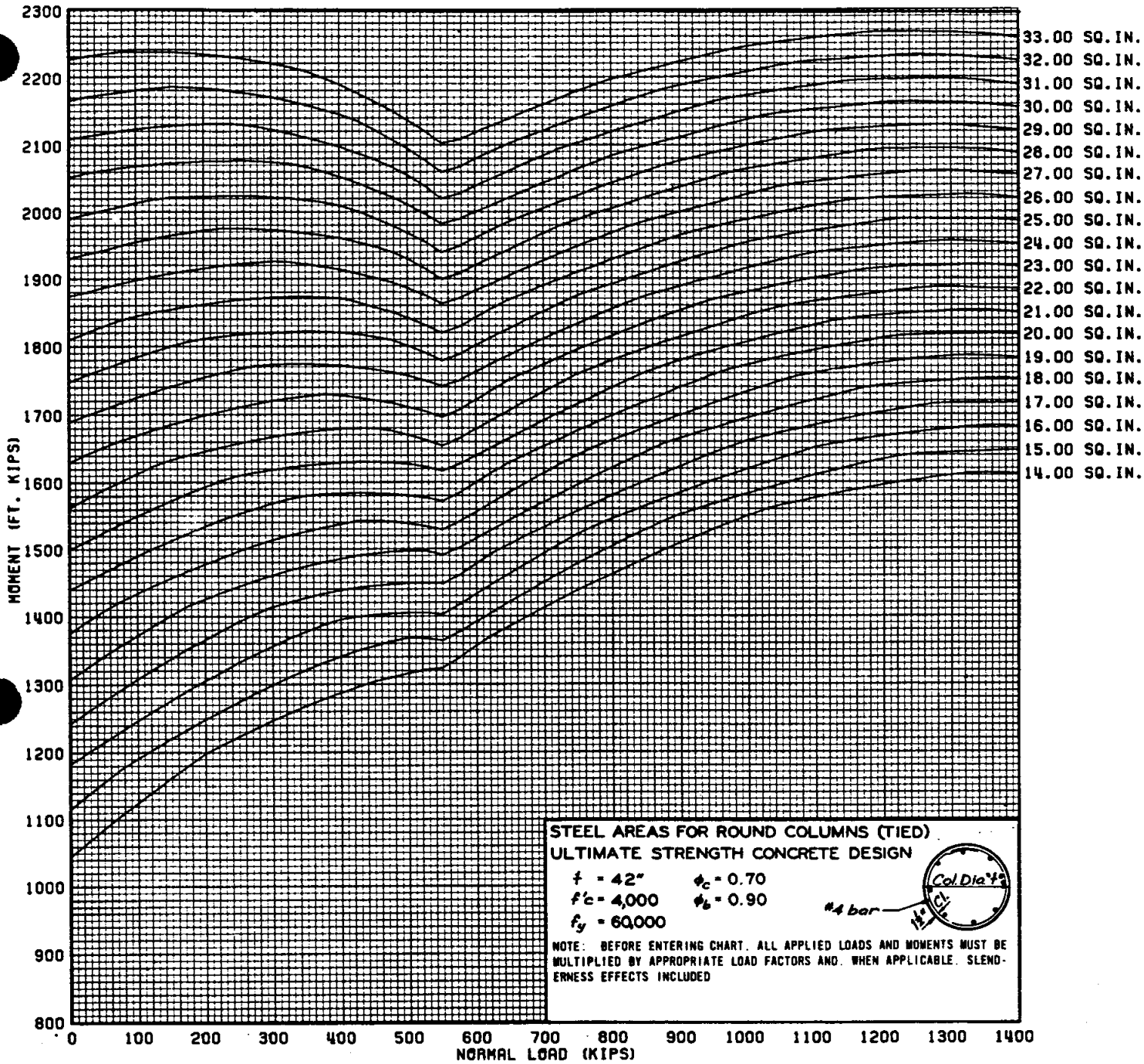


NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND, WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.

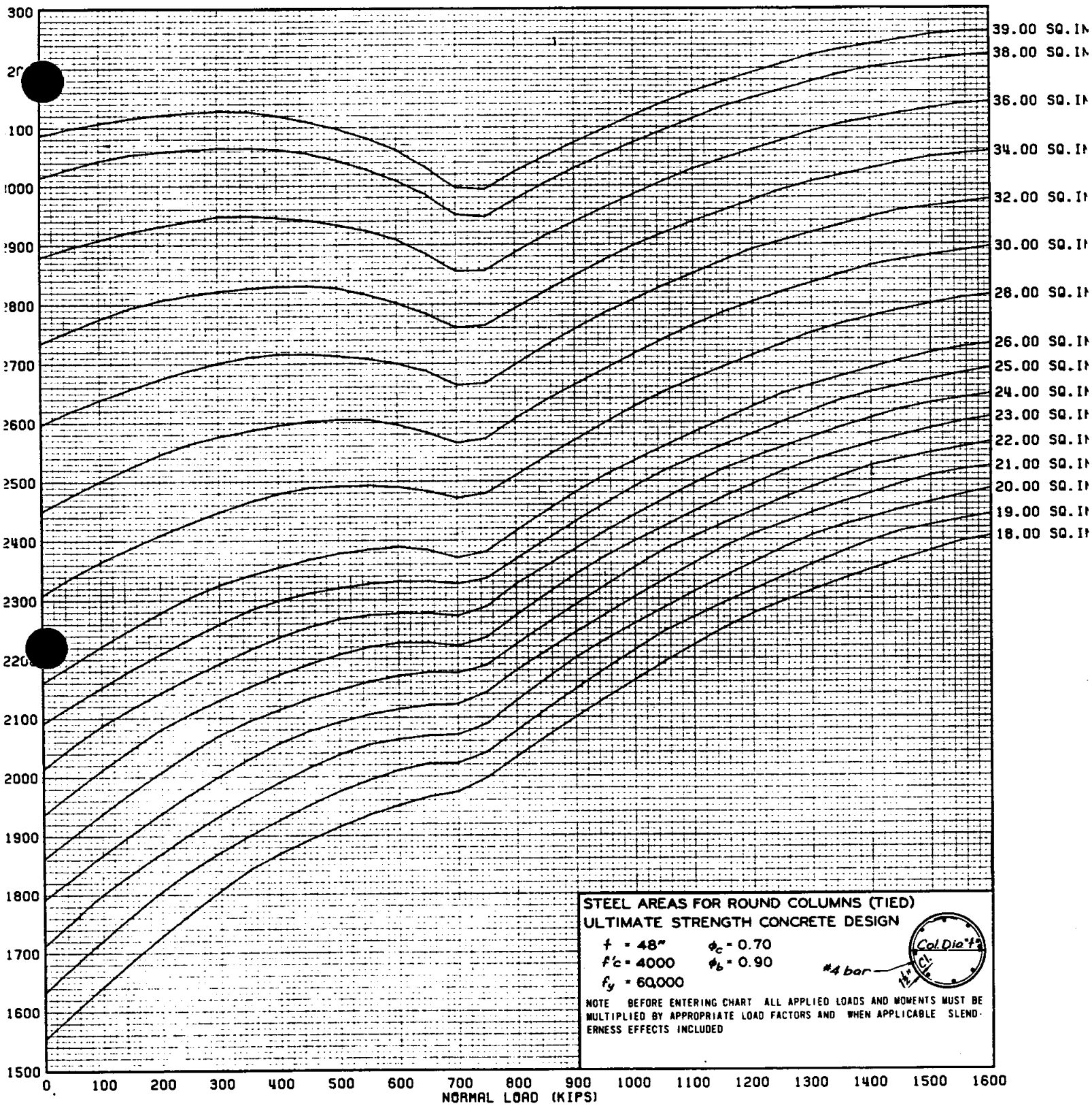

1000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
MOMENT (FT. KIPS)
0
100
200
300
400
500
600
700
800
900
1000
NORMAL LOAD (KIPS)
22.00 SQ.IN.
21.00 SQ.IN.
20.00 SQ.IN.
19.00 SQ.IN.
18.00 SQ.IN.
17.00 SQ.IN.
16.00 SQ.IN.
15.00 SQ.IN.
14.00 SQ.IN.
13.00 SQ.IN.
12.00 SQ.IN.
11.00 SQ.IN.
10.00 SQ.IN.
9.00 SQ.IN.
8.00 SQ.IN.
7.11 SQ.IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
t = 30"
f'c = 4,000
fy = 60,000
φc = 0.70
φb = 0.90
Col. Dia "t"
Cl.
#4 bar
1½"
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND, WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.

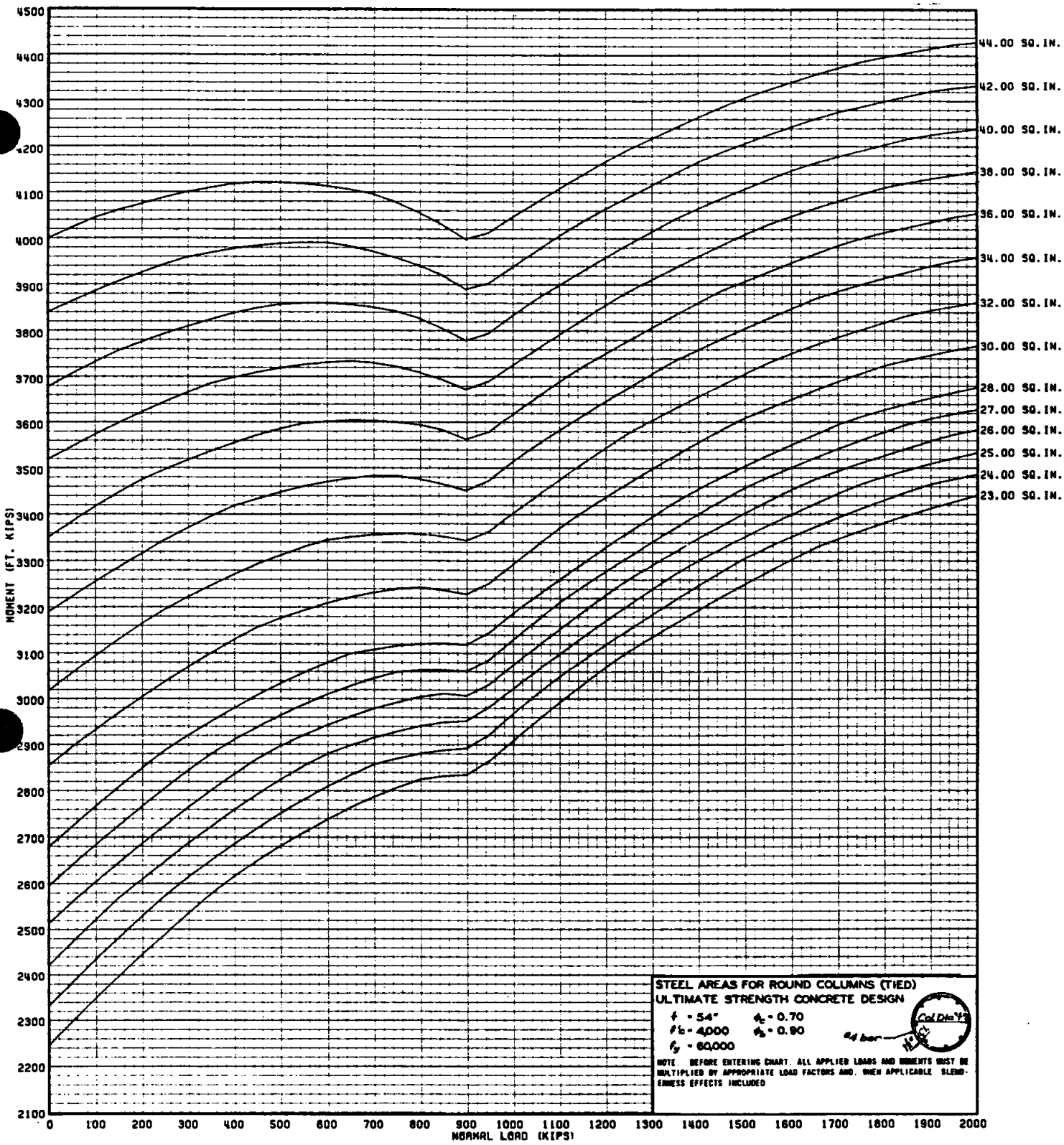


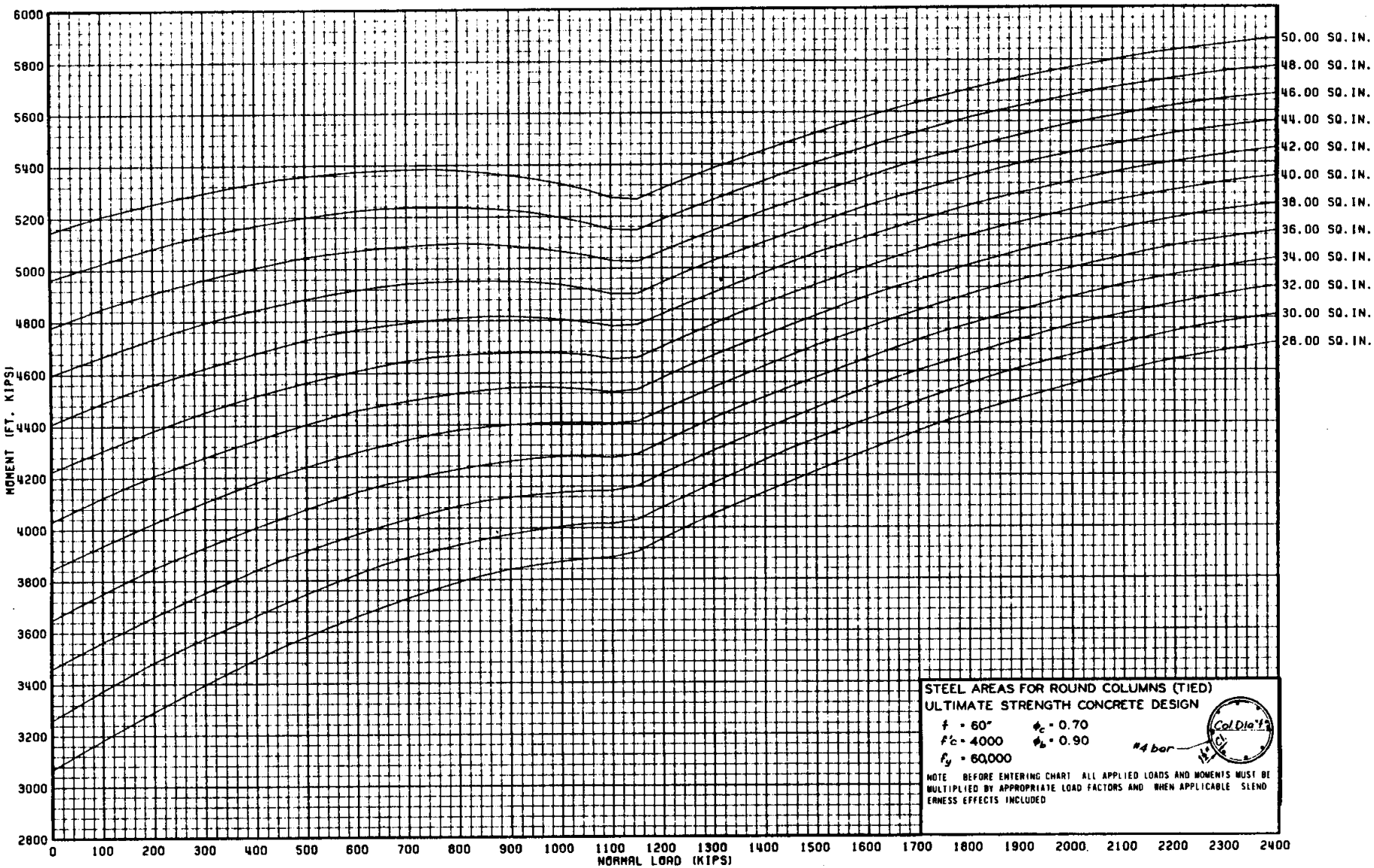
1600
1550
1500
1450
1400
1350
1300
1250
1200
1150
1100
1050
1000
950
900
850
800
750
700
650
MOMENT (FT. KIPS)
0
100
200
300
400
500
600
700
800
900
1000
1100
NORMAL LOAD (KIPS)
28.00 SQ.IN.
27.00 SQ.IN.
26.00 SQ.IN.
25.00 SQ.IN.
24.00 SQ.IN.
23.00 SQ.IN.
22.00 SQ.IN.
21.00 SQ.IN.
20.00 SQ.IN.
19.00 SQ.IN.
18.00 SQ.IN.
17.00 SQ.IN.
16.00 SQ.IN.
15.00 SQ.IN.
14.00 SQ.IN.
13.00 SQ.IN.
12.00 SQ.IN.
11.00 SQ.IN.
10.00 SQ.IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
f = 36"
f'c = 4,000
fy = 60,000
φc = 0.70
φb = 0.90
#4 bar
Col. Dia "t"
Cl.
NOTE. BEFORE ENTERING CHART. ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND. WHEN APPLICABLE SLENDERNESS EFFECTS INCLUDED

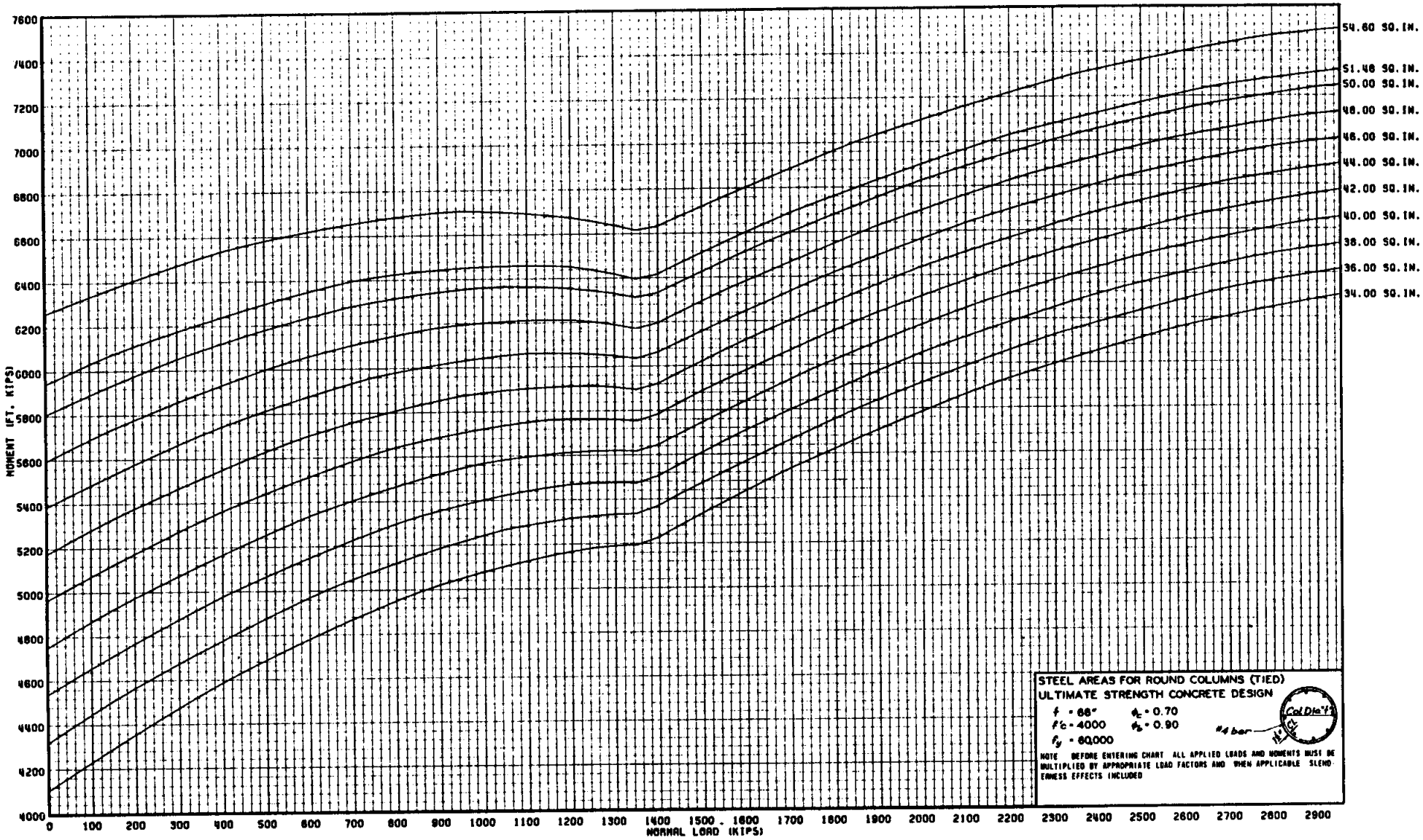


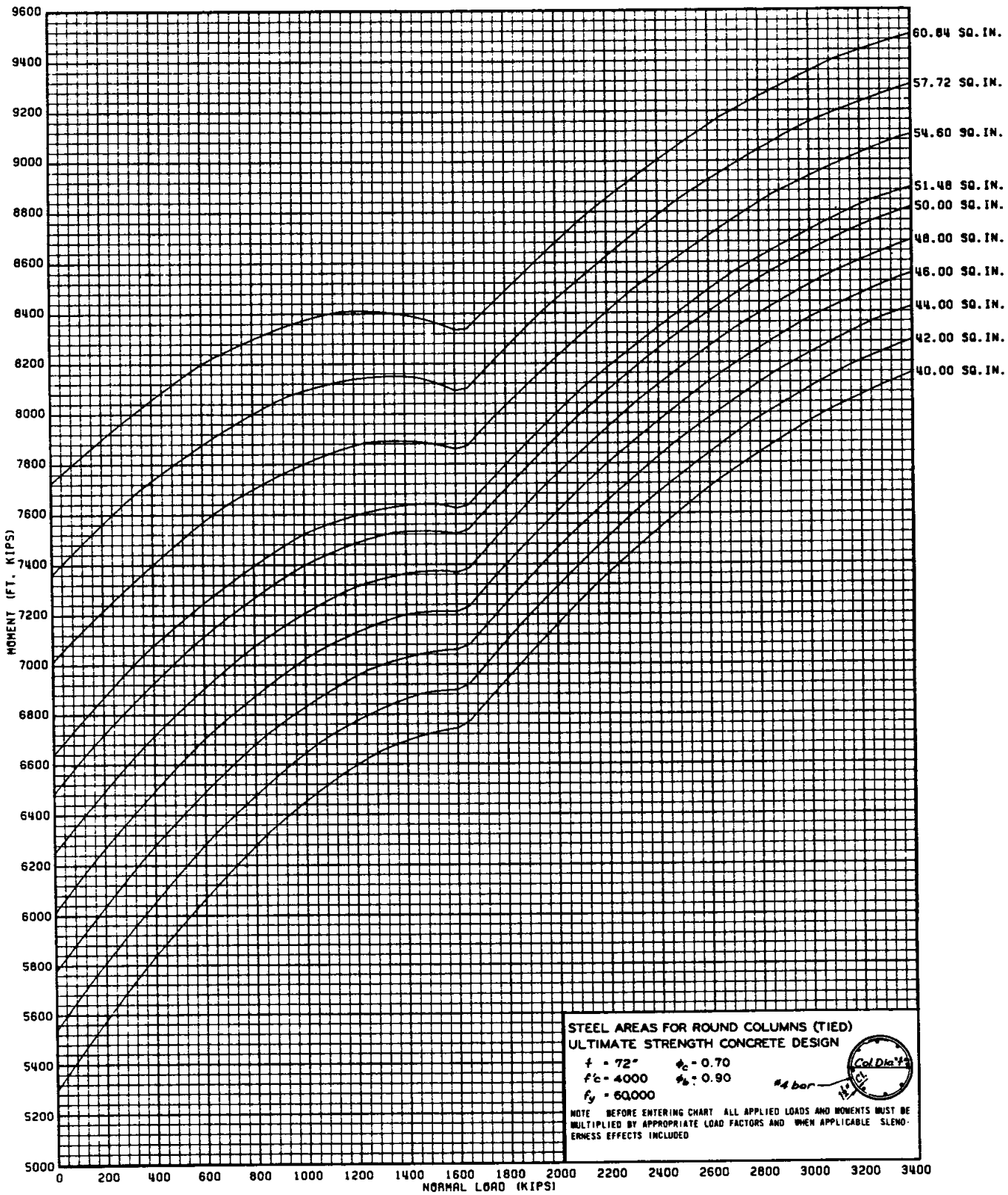
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
MOMENT (FT. KIPS)
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
NORMAL LOAD (KIPS)
33.00 SQ.IN.
32.00 SQ.IN.
31.00 SQ.IN.
30.00 SQ.IN.
29.00 SQ.IN.
28.00 SQ.IN.
27.00 SQ.IN.
26.00 SQ.IN.
25.00 SQ.IN.
24.00 SQ.IN.
23.00 SQ.IN.
22.00 SQ.IN.
21.00 SQ.IN.
20.00 SQ.IN.
19.00 SQ.IN.
18.00 SQ.IN.
17.00 SQ.IN.
16.00 SQ.IN.
15.00 SQ.IN.
14.00 SQ.IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
f = 42"
f'c = 4,000
fy = 60,000
φc = 0.70
φb = 0.90
#4 bar
Col. Dia. f
Cl.
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND, WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED

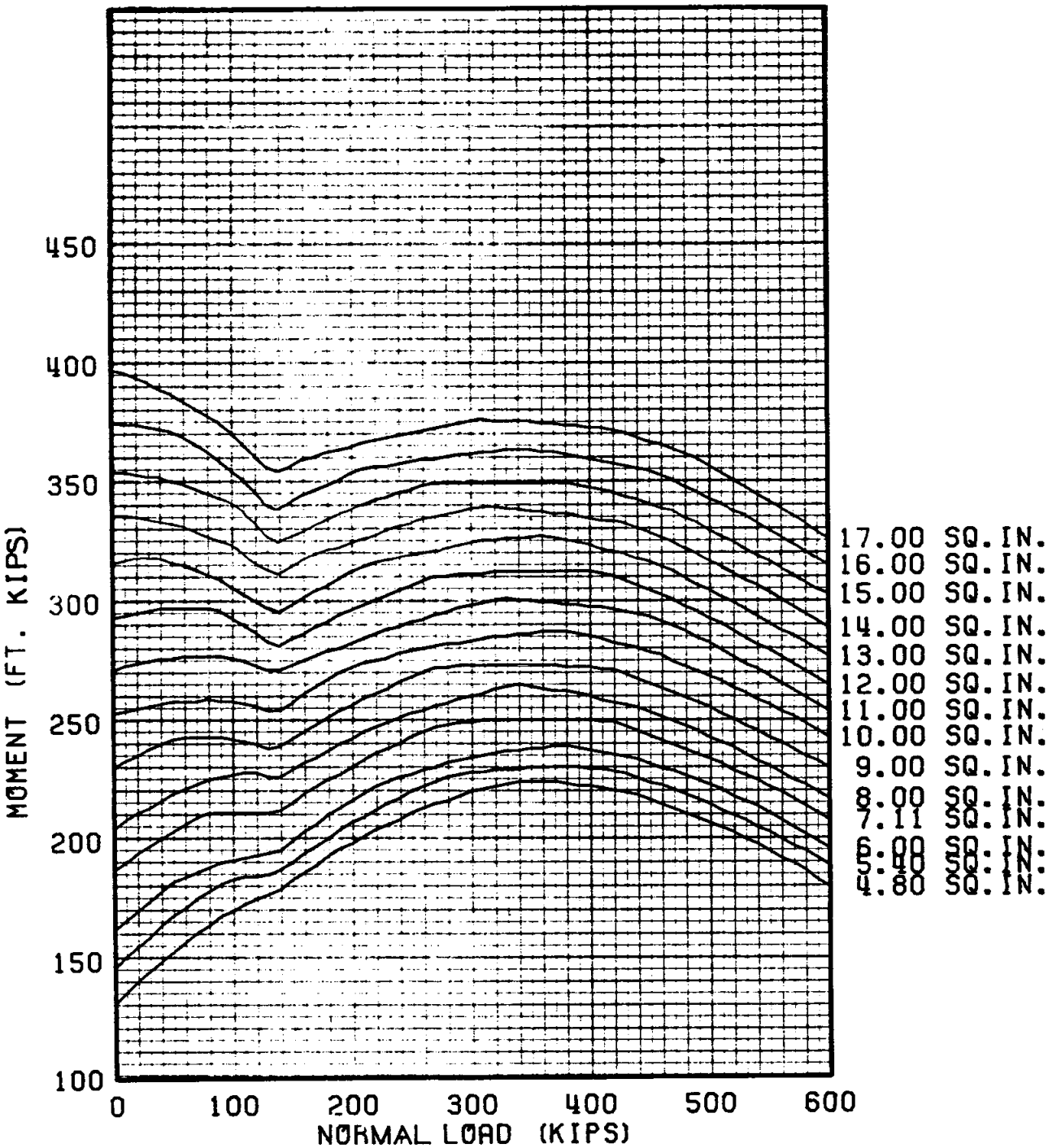

39.00 SQ.IN
38.00 SQ.IN
36.00 SQ.IN
34.00 SQ.IN
32.00 SQ.IN
30.00 SQ.IN
28.00 SQ.IN
26.00 SQ.IN
25.00 SQ.IN
24.00 SQ.IN
23.00 SQ.IN
22.00 SQ.IN
21.00 SQ.IN
20.00 SQ.IN
19.00 SQ.IN
18.00 SQ.IN
300
100
1000
2900
2800
2700
2600
2500
2400
2300
2100
2000
1900
1800
1700
1600
1500
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
NORMAL LOAD (KIPS)
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
t = 48"
f'c = 4000
fy = 60,000
φc = 0.70
φb = 0.90
Col. Dia "t"
#4 bar
1½"
Cl.
NOTE BEFORE ENTERING CHART ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE SLENDERNESS EFFECTS INCLUDED


MOMENT (FT. KIPS)
NORMAL LOAD (KIPS)
44.00 SQ. IN.
42.00 SQ. IN.
40.00 SQ. IN.
38.00 SQ. IN.
36.00 SQ. IN.
34.00 SQ. IN.
32.00 SQ. IN.
30.00 SQ. IN.
28.00 SQ. IN.
27.00 SQ. IN.
26.00 SQ. IN.
25.00 SQ. IN.
24.00 SQ. IN.
23.00 SQ. IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
f = 54"
f'c = 4,000
fy = 60,000
φc = 0.70
φb = 0.90
#4 bar
Col Dia 42"
NOTE. BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND, WHEN APPLICABLE SLENDERNESS EFFECTS INCLUDED


MOMENT (FT. KIPS)
6000
5800
5600
5400
5200
5000
4800
4600
4400
4200
4000
3800
3600
3400
3200
3000
2800
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
NORMAL LOAD (KIPS)
50.00 SQ. IN.
48.00 SQ. IN.
46.00 SQ. IN.
44.00 SQ. IN.
42.00 SQ. IN.
40.00 SQ. IN.
38.00 SQ. IN.
36.00 SQ. IN.
34.00 SQ. IN.
32.00 SQ. IN.
30.00 SQ. IN.
28.00 SQ. IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
f = 60"
f'c = 4000
fy = 60,000
φc = 0.70
φb = 0.90
Col Dia "f"
#4 bar
NOTE BEFORE ENTERING CHART ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE SLENDERNESS EFFECTS INCLUDED

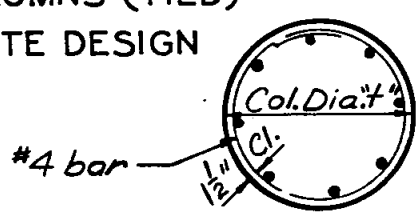

MOMENT (FT. KIPS)
7600
7400
7200
7000
6800
6600
6400
6200
6000
5800
5600
5400
5200
5000
4800
4600
4400
4200
4000
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
2500
2600
2700
2800
2900
NORMAL LOAD (KIPS)
54.60 SQ. IN.
51.48 SQ. IN.
50.00 SQ. IN.
48.00 SQ. IN.
46.00 SQ. IN.
44.00 SQ. IN.
42.00 SQ. IN.
40.00 SQ. IN.
38.00 SQ. IN.
36.00 SQ. IN.
34.00 SQ. IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
f = 66"
f'c = 4000
fy = 60,000
φc = 0.70
φb = 0.90
#4 bar
Col Dia "f"
NOTE BEFORE ENTERING CHART ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE SLENDERNESS EFFECTS INCLUDED


60.84 SQ. IN.
57.72 SQ. IN.
54.60 SQ. IN.
51.48 SQ. IN.
50.00 SQ. IN.
48.00 SQ. IN.
46.00 SQ. IN.
44.00 SQ. IN.
42.00 SQ. IN.
40.00 SQ. IN.
MOMENT (FT. KIPS)
9600
9400
9200
9000
8800
8600
8400
8200
8000
7800
7600
7400
7200
7000
6800
6600
6400
6200
6000
5800
5600
5400
5200
5000
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
NORMAL LOAD (KIPS)
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
f = 72"
f'c = 4000
fy = 60,000
φc = 0.70
φb = 0.90
Col. Dia. "f"
#4 bar
NOTE BEFORE ENTERING CHART ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE SLENDERNESS EFFECTS INCLUDED

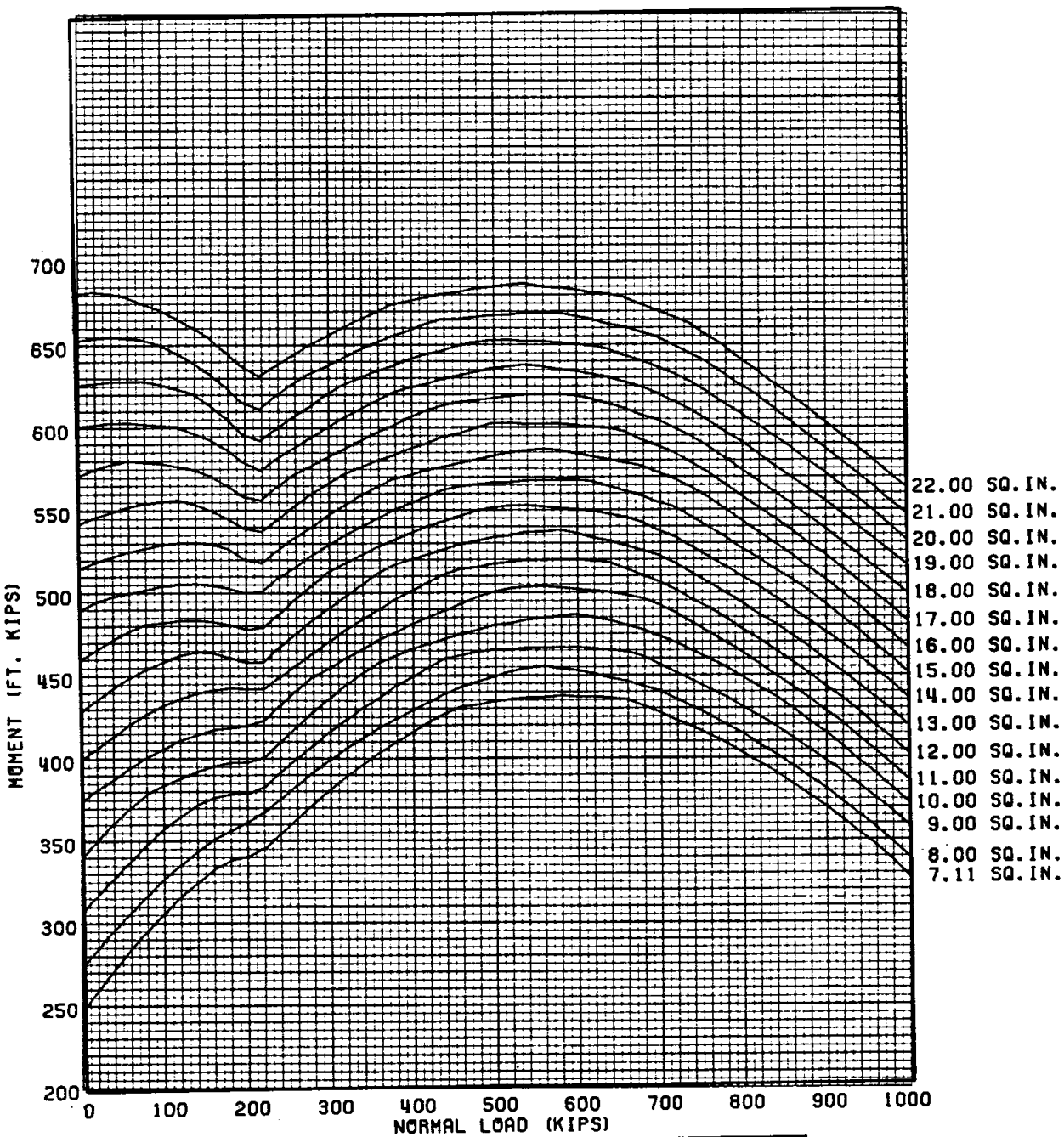


STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN

"t" = 24" ϕ_c = 0.70
$f'c$ = 3,000 ϕ_b = 0.90
f_y = 40,000

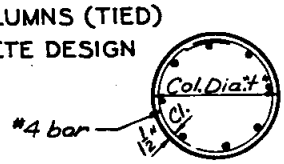


NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.

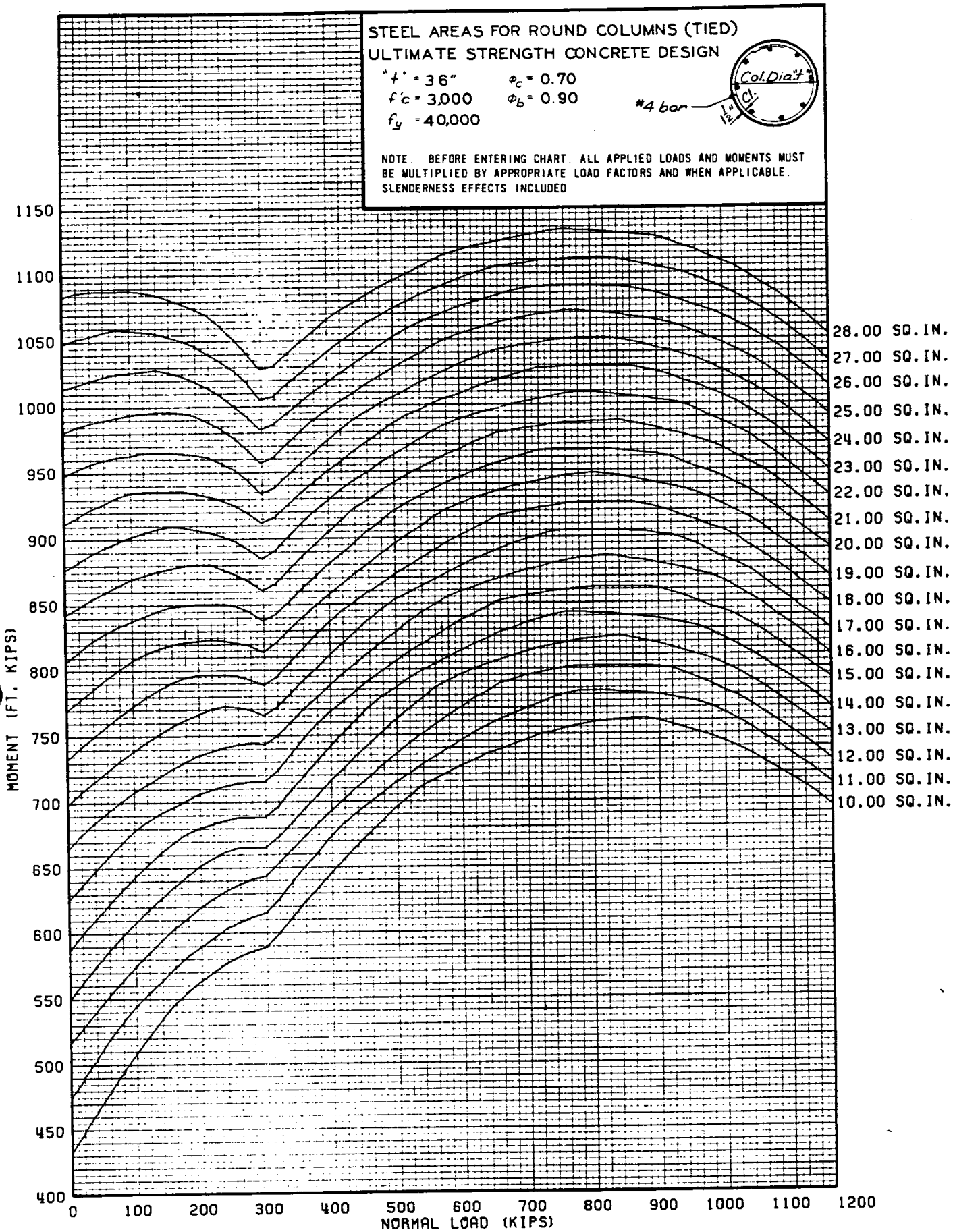


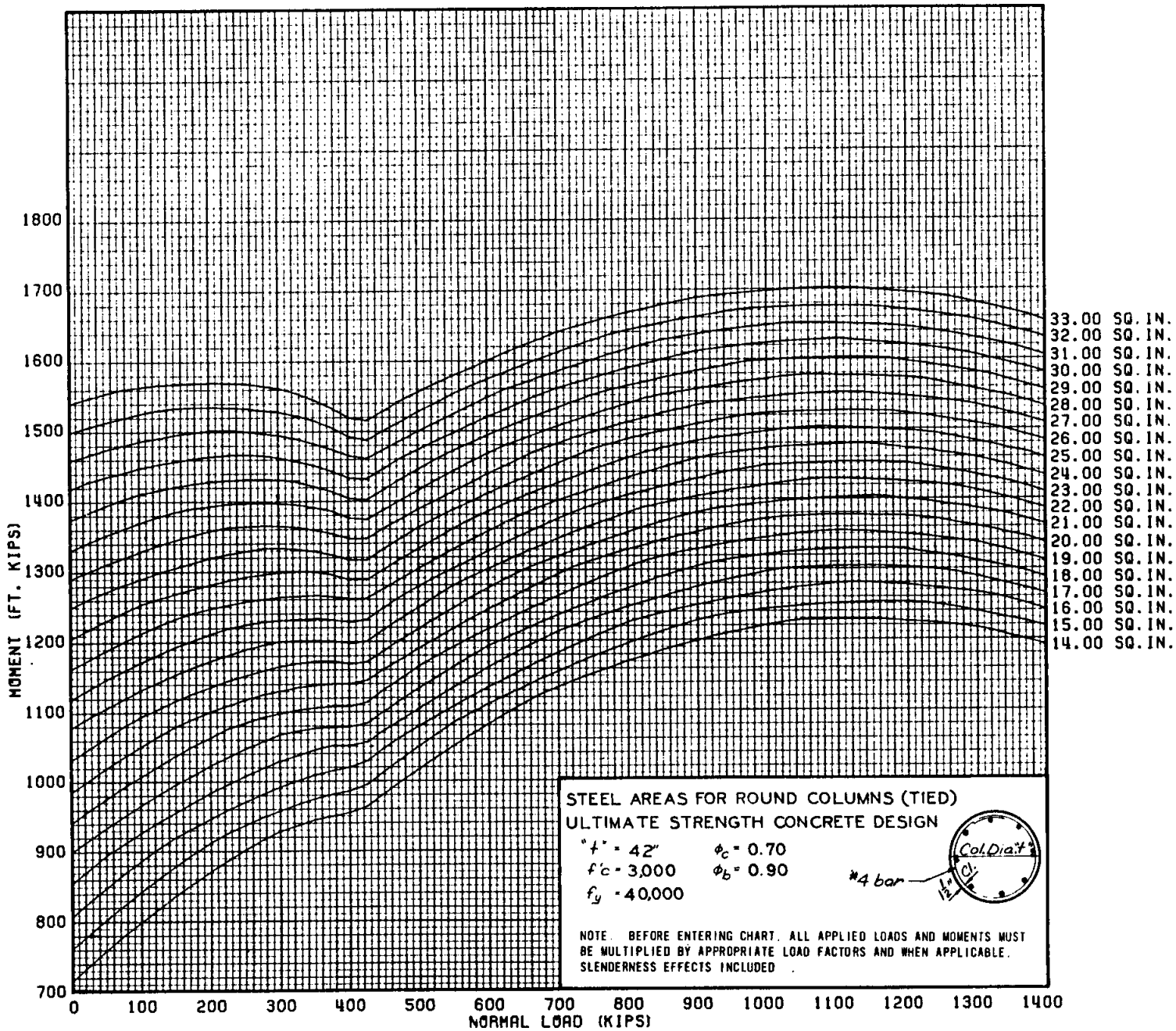
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN

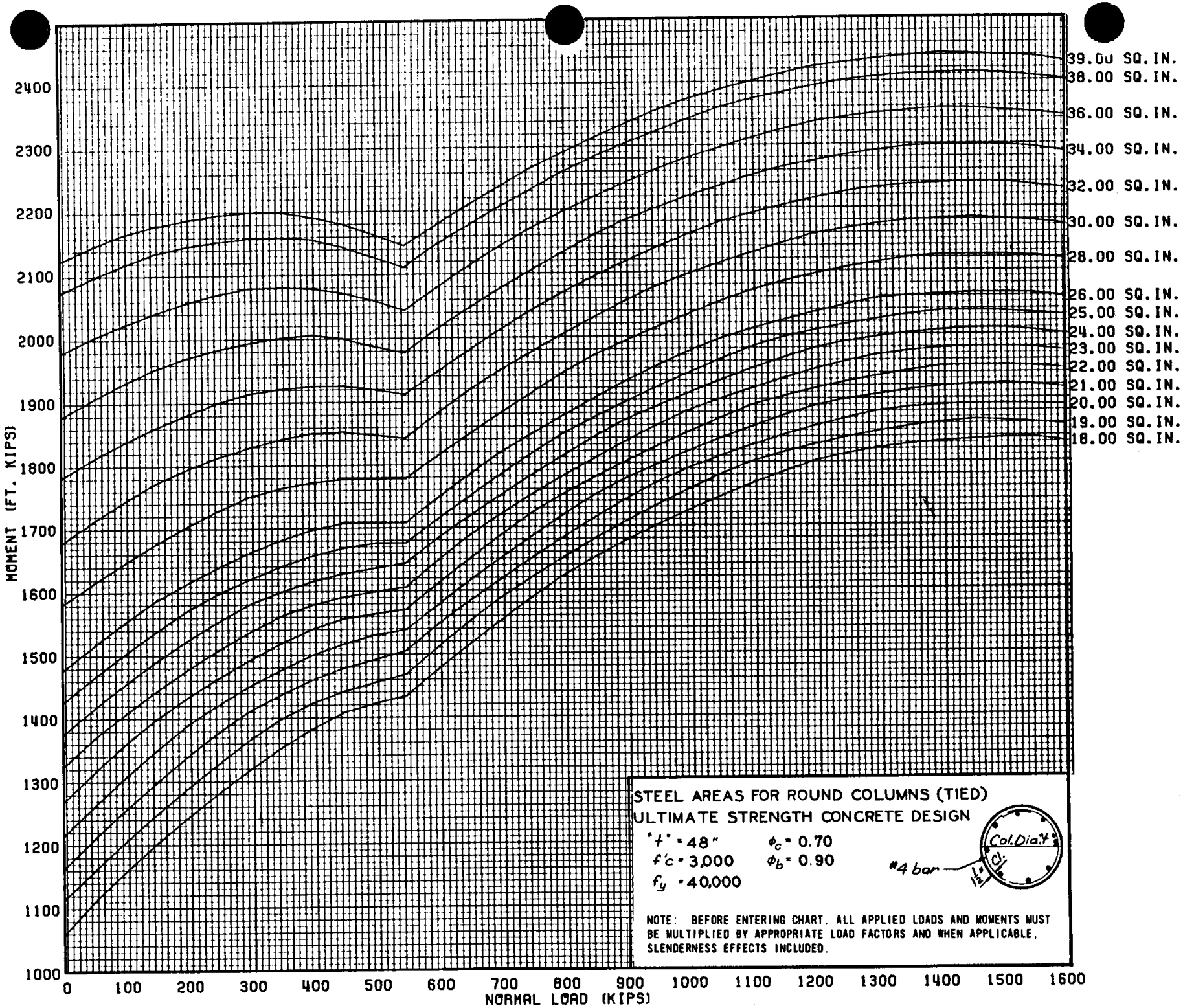
"t" = 30" ϕ_c = 0.70
f'c = 3,000 ϕ_b = 0.90
f_y = 40,000

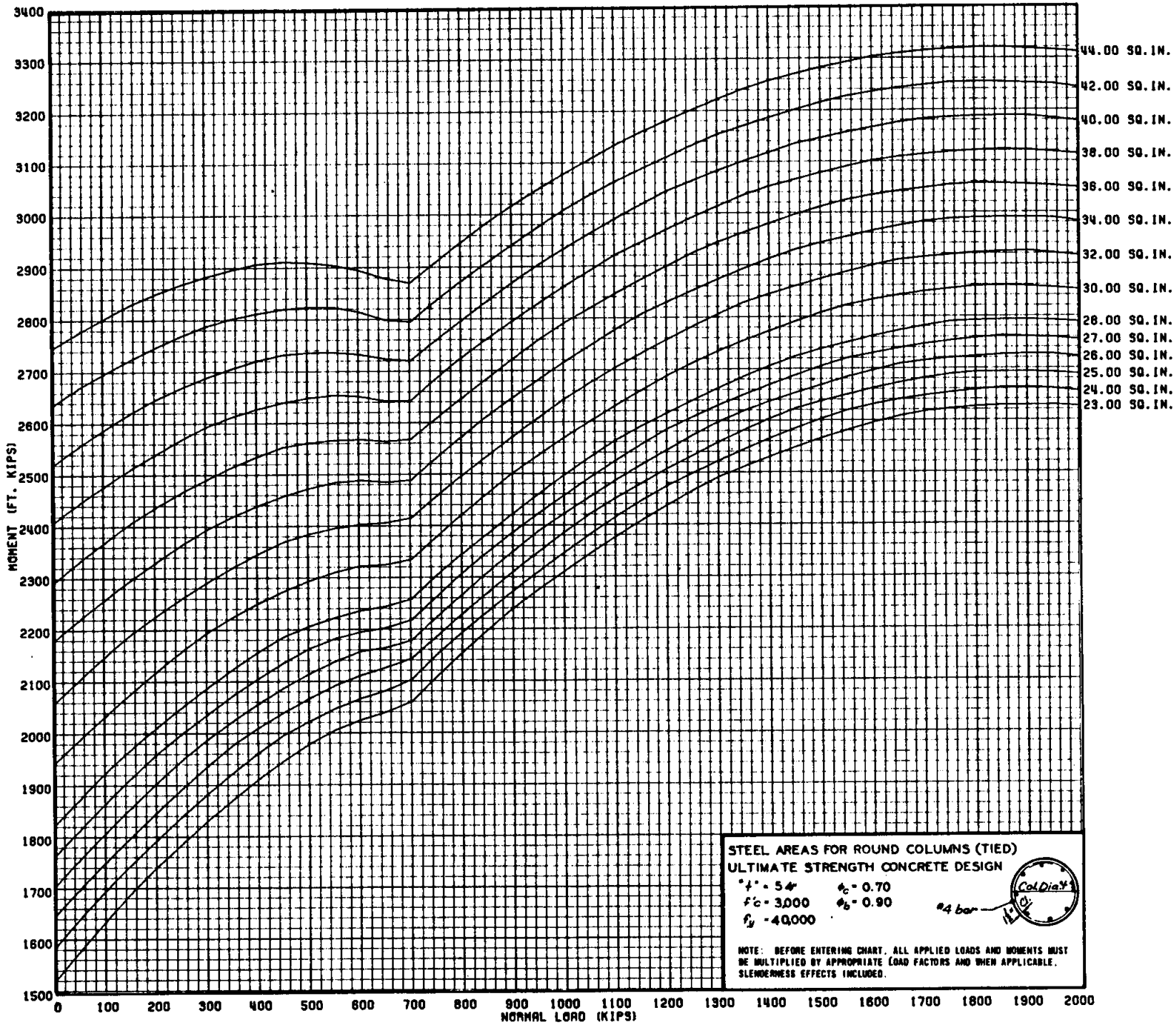


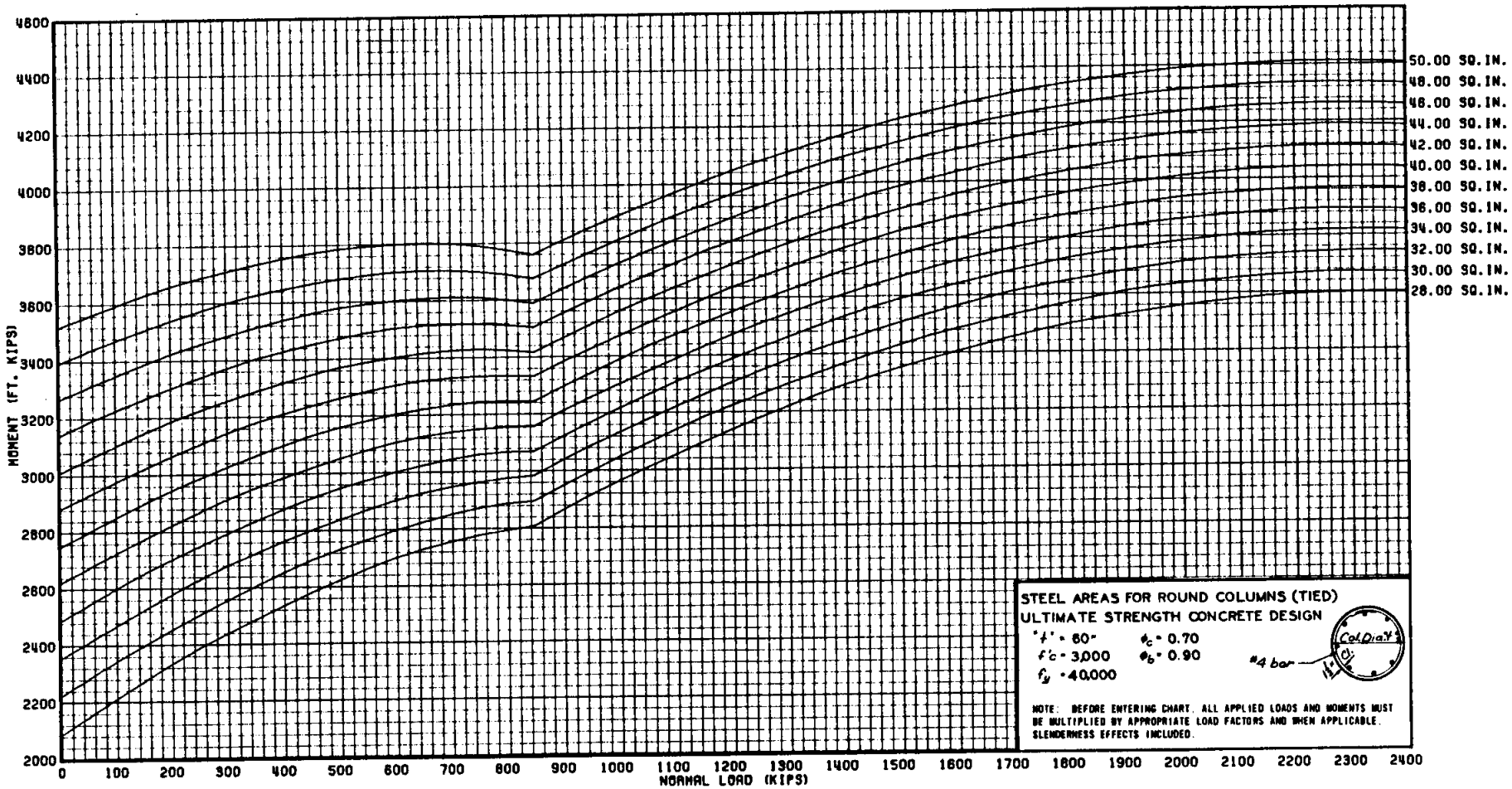
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.


STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
"t" = 36"
f'c = 3,000
fy = 40,000
φc = 0.70
φb = 0.90
Col. Dia. "t"
Cl.
#4 bar
1½"
NOTE. BEFORE ENTERING CHART. ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE. SLENDERNESS EFFECTS INCLUDED
MOMENT (FT. KIPS)
NORMAL LOAD (KIPS)
28.00 SQ. IN.
27.00 SQ. IN.
26.00 SQ. IN.
25.00 SQ. IN.
24.00 SQ. IN.
23.00 SQ. IN.
22.00 SQ. IN.
21.00 SQ. IN.
20.00 SQ. IN.
19.00 SQ. IN.
18.00 SQ. IN.
17.00 SQ. IN.
16.00 SQ. IN.
15.00 SQ. IN.
14.00 SQ. IN.
13.00 SQ. IN.
12.00 SQ. IN.
11.00 SQ. IN.
10.00 SQ. IN.

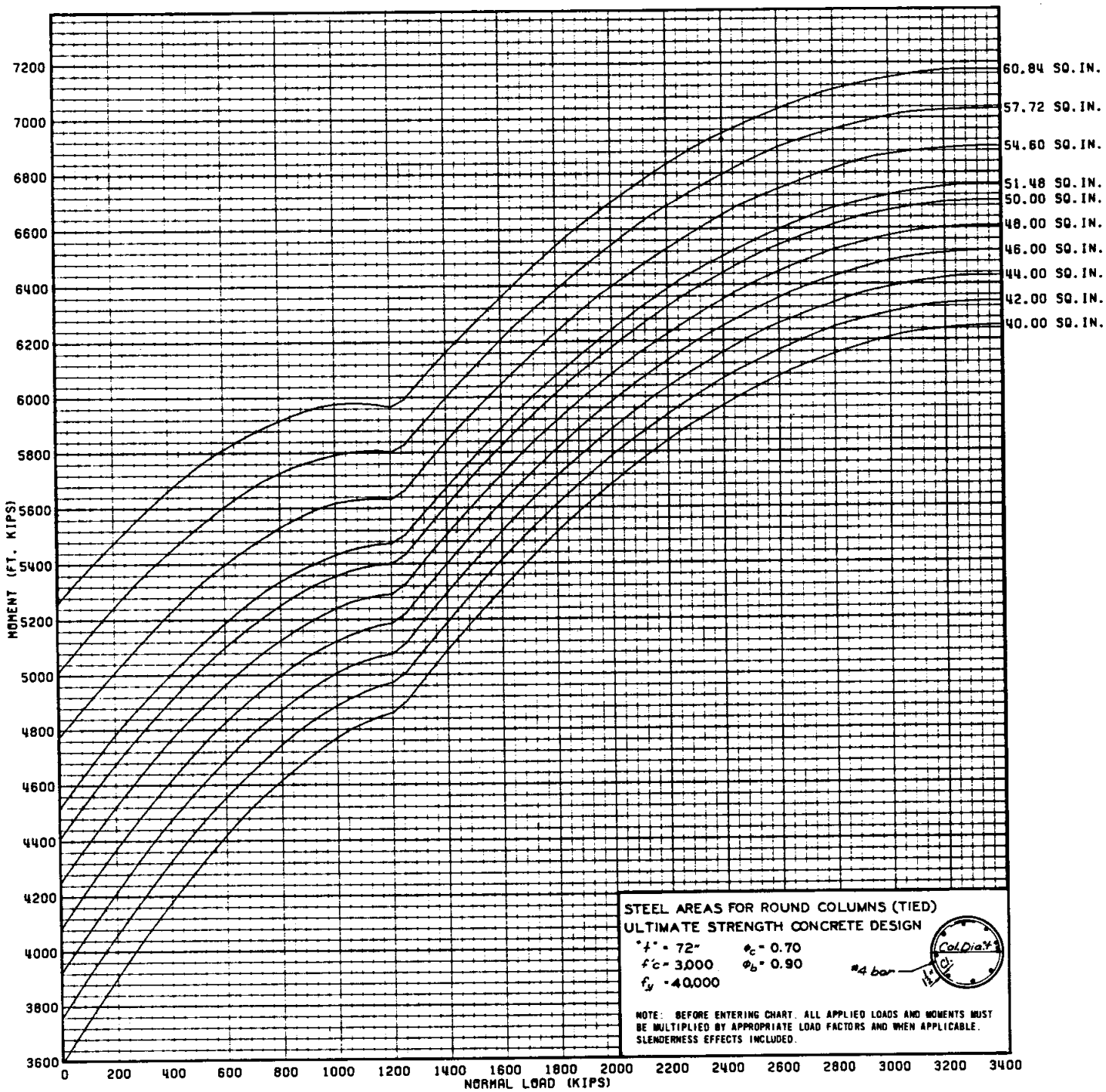

MOMENT (FT. KIPS)
NORMAL LOAD (KIPS)
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
33.00 SQ. IN.
32.00 SQ. IN.
31.00 SQ. IN.
30.00 SQ. IN.
29.00 SQ. IN.
28.00 SQ. IN.
27.00 SQ. IN.
26.00 SQ. IN.
25.00 SQ. IN.
24.00 SQ. IN.
23.00 SQ. IN.
22.00 SQ. IN.
21.00 SQ. IN.
20.00 SQ. IN.
19.00 SQ. IN.
18.00 SQ. IN.
17.00 SQ. IN.
16.00 SQ. IN.
15.00 SQ. IN.
14.00 SQ. IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
"t" = 42"
f'c = 3,000
fy = 40,000
φc = 0.70
φb = 0.90
#4 bar
Col. Dia. "t"
Cl
1½"
NOTE. BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED .

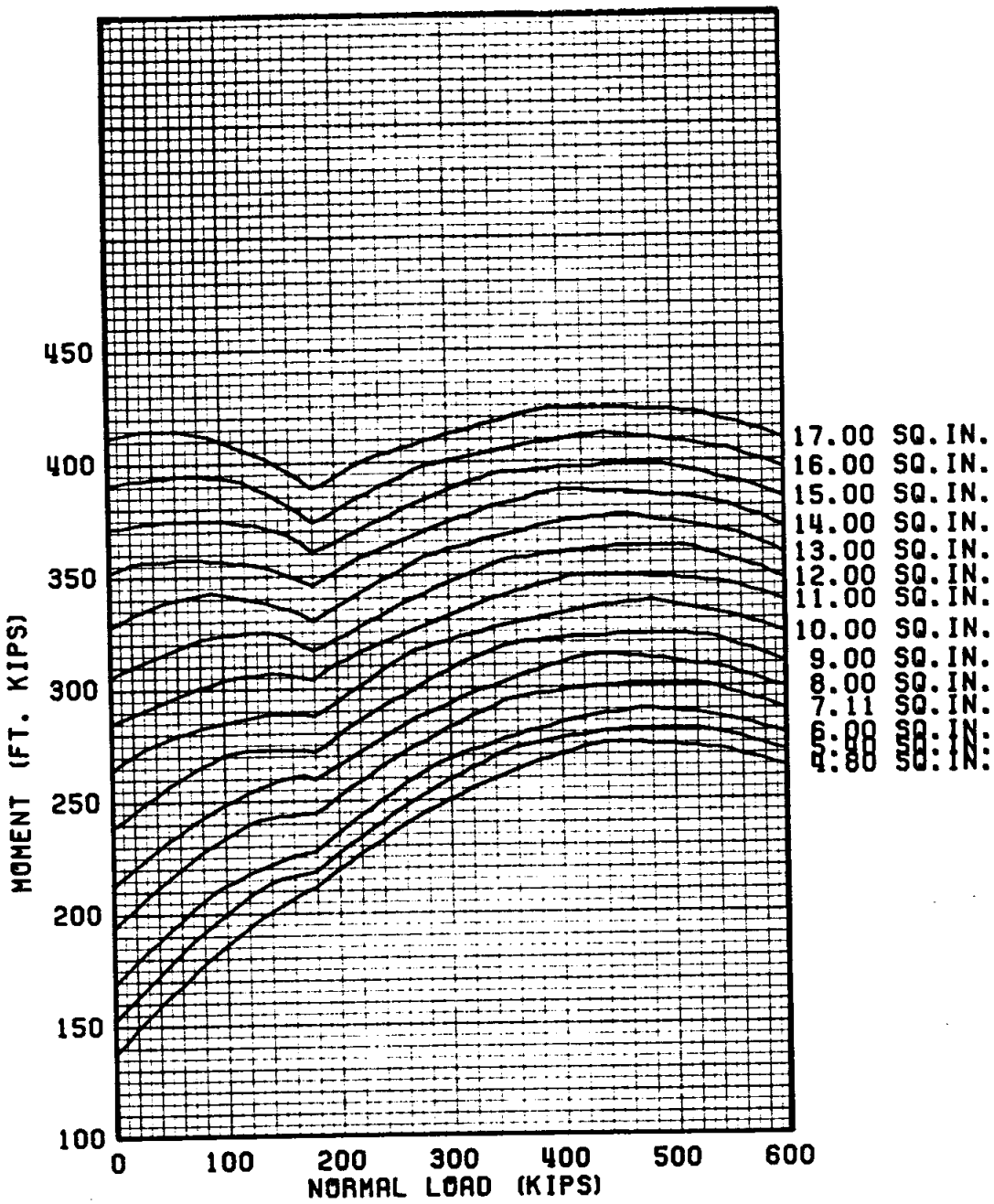

39.00 SQ. IN.
38.00 SQ. IN.
36.00 SQ. IN.
34.00 SQ. IN.
32.00 SQ. IN.
30.00 SQ. IN.
28.00 SQ. IN.
26.00 SQ. IN.
25.00 SQ. IN.
24.00 SQ. IN.
23.00 SQ. IN.
22.00 SQ. IN.
21.00 SQ. IN.
20.00 SQ. IN.
19.00 SQ. IN.
18.00 SQ. IN.
MOMENT (FT. KIPS)
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
NORMAL LOAD (KIPS)
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
"t" = 48"
f'c = 3,000
fy = 40,000
φc = 0.70
φb = 0.90
#4 bar
Col. Dia. "t"
Cl.
1½"
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.


MOMENT (FT. KIPS)
3400
3300
3200
3100
3000
2900
2800
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
NORMAL LOAD (KIPS)
44.00 SQ.IN.
42.00 SQ.IN.
40.00 SQ.IN.
38.00 SQ.IN.
36.00 SQ.IN.
34.00 SQ.IN.
32.00 SQ.IN.
30.00 SQ.IN.
28.00 SQ.IN.
27.00 SQ.IN.
26.00 SQ.IN.
25.00 SQ.IN.
24.00 SQ.IN.
23.00 SQ.IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
"t" = 54
f'c = 3,000
fy = 40,000
φc = 0.70
φb = 0.90
#4 bar
Col. Dia.
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.


MOMENT (FT. KIPS)
4800
4400
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
NORMAL LOAD (KIPS)
50.00 SQ.IN.
48.00 SQ.IN.
46.00 SQ.IN.
44.00 SQ.IN.
42.00 SQ.IN.
40.00 SQ.IN.
38.00 SQ.IN.
36.00 SQ.IN.
34.00 SQ.IN.
32.00 SQ.IN.
30.00 SQ.IN.
28.00 SQ.IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
"f" = 60"
f'c = 3,000
fy = 40,000
φc = 0.70
φb = 0.90
#4 bar
Col. Dia.
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.

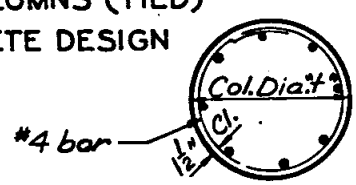
MOMENT (FT. KIPS)
NORMAL LOAD (KIPS)
54.80 SQ.IN.
51.48 SQ.IN.
50.00 SQ.IN.
48.00 SQ.IN.
46.00 SQ.IN.
44.00 SQ.IN.
42.00 SQ.IN.
40.00 SQ.IN.
38.00 SQ.IN.
36.00 SQ.IN.
34.00 SQ.IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
"f" = 66
f'c = 3,000
fy = 40,000
φc = 0.70
φb = 0.90
#4 bar
Col.Dia.
NOTE: BEFORE ENTERING CHART ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.


60.84 SQ. IN.
57.72 SQ. IN.
54.60 SQ. IN.
51.48 SQ. IN.
50.00 SQ. IN.
48.00 SQ. IN.
46.00 SQ. IN.
44.00 SQ. IN.
42.00 SQ. IN.
40.00 SQ. IN.
MOMENT (FT. KIPS)
NORMAL LOAD (KIPS)
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
"t" = 72"
f'c = 3,000
fy = 40,000
φc = 0.70
φb = 0.90
#4 bar
Col. Dia.
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.

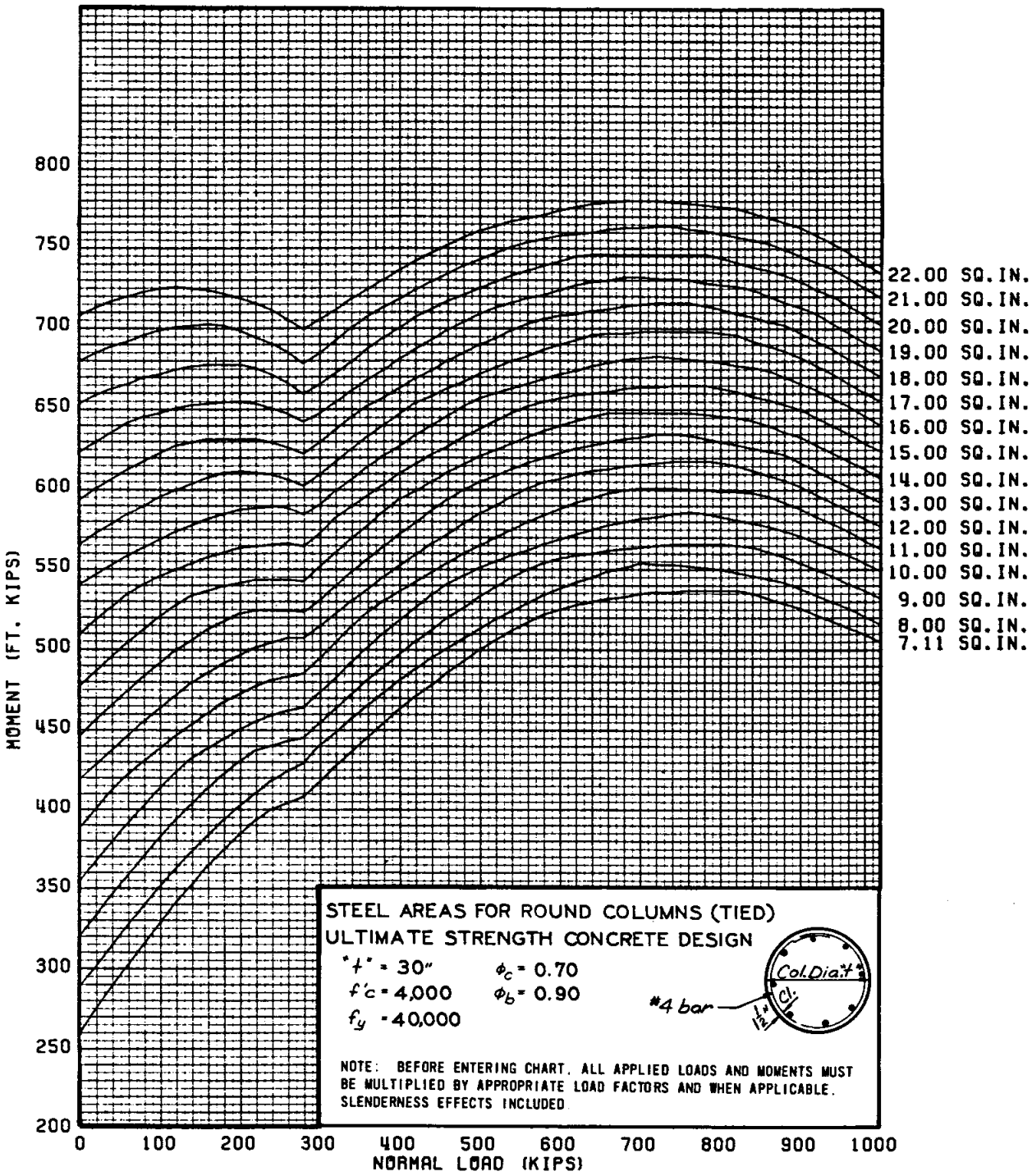


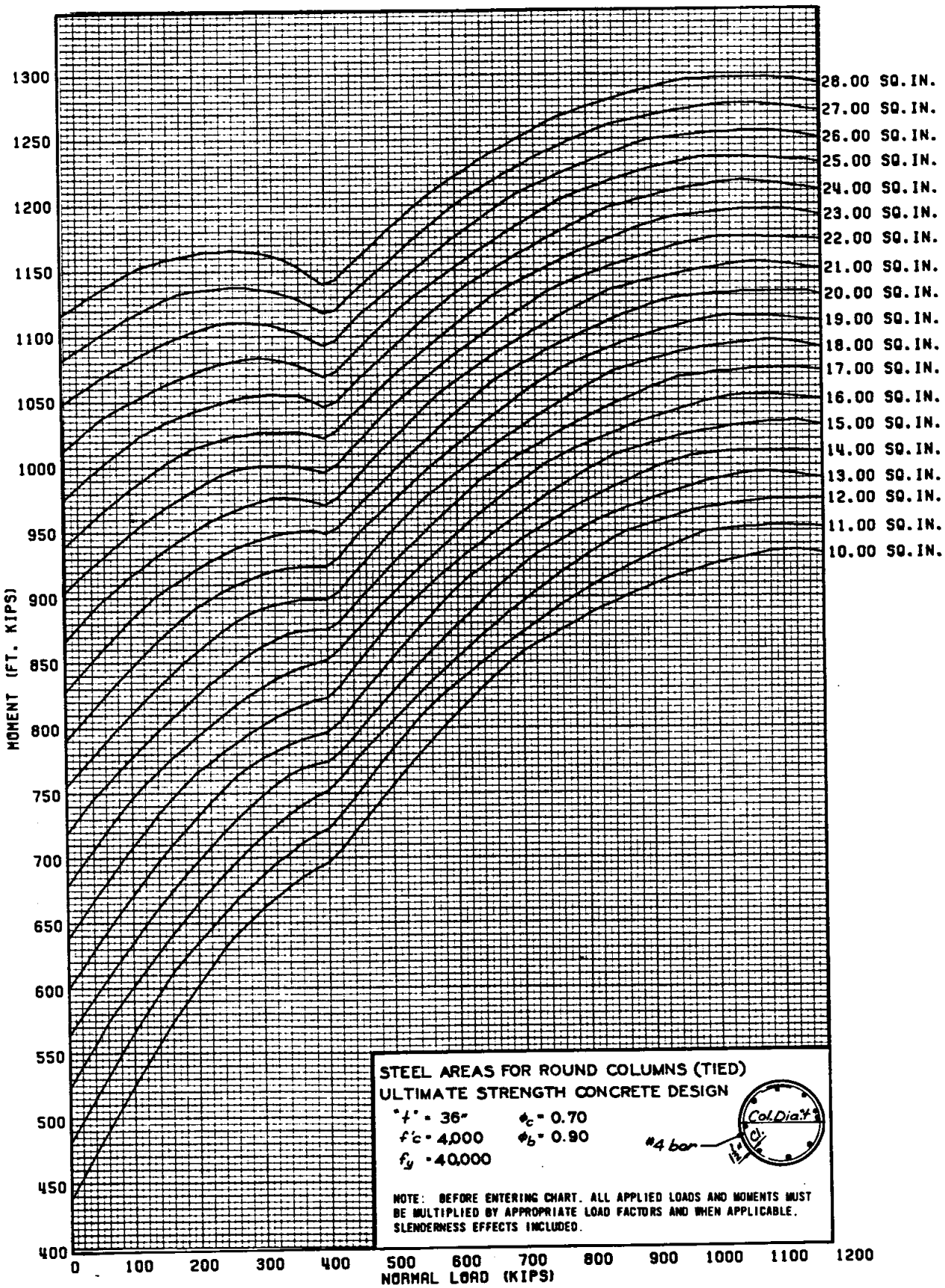
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN

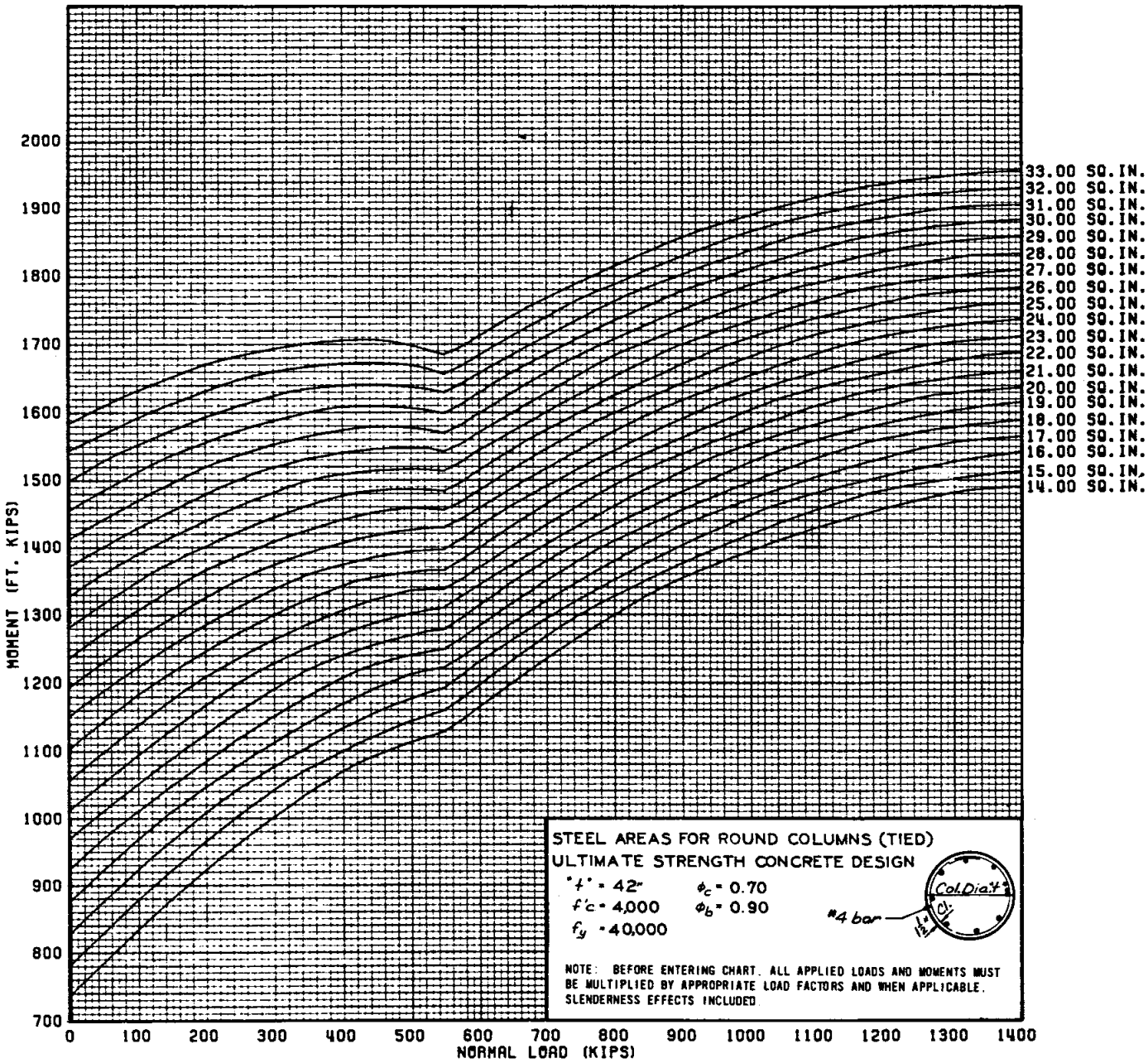
"t" = 24" ϕ_c = 0.70
f'c = 4,000 ϕ_b = 0.90
f_y = 40,000

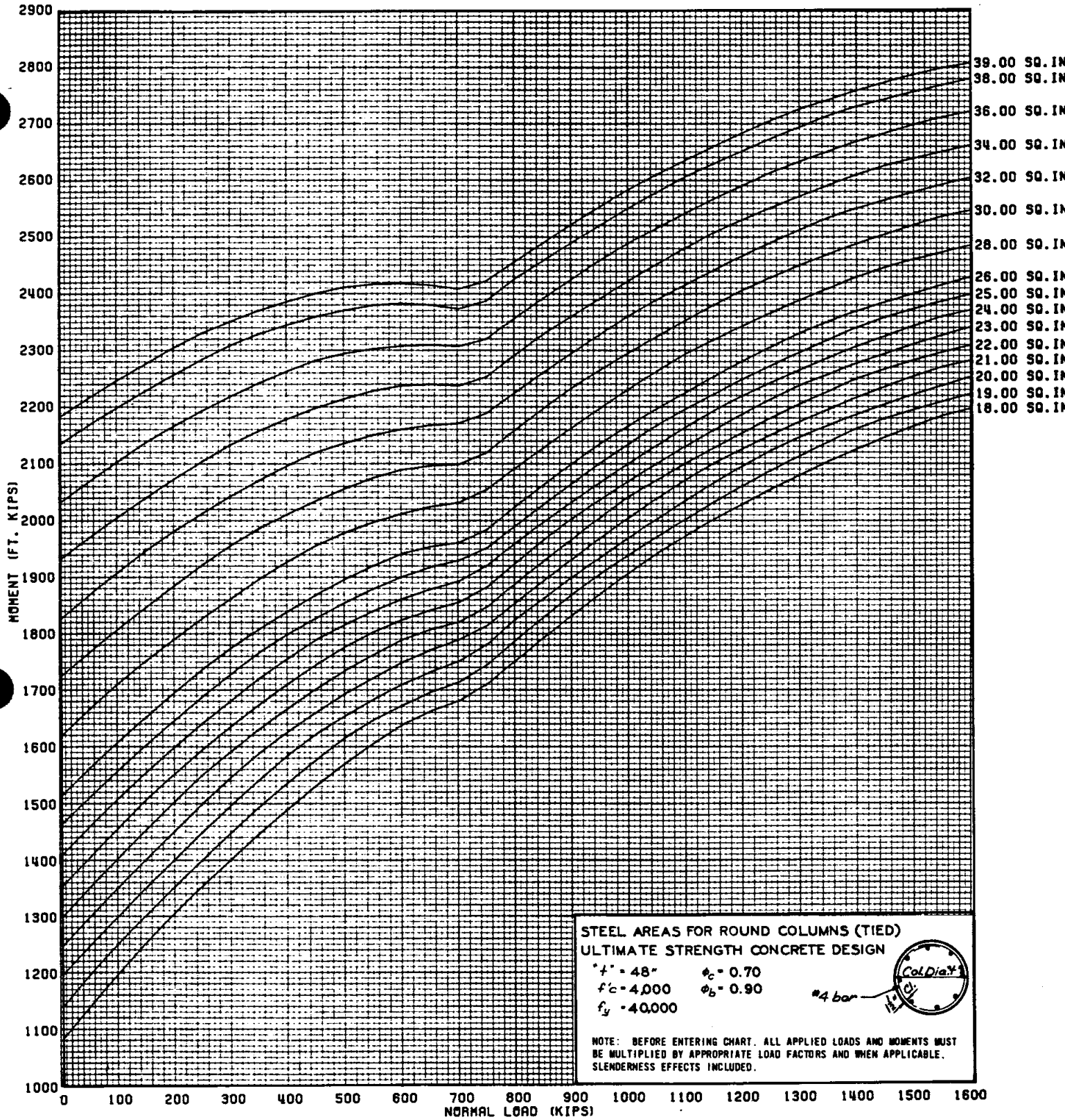


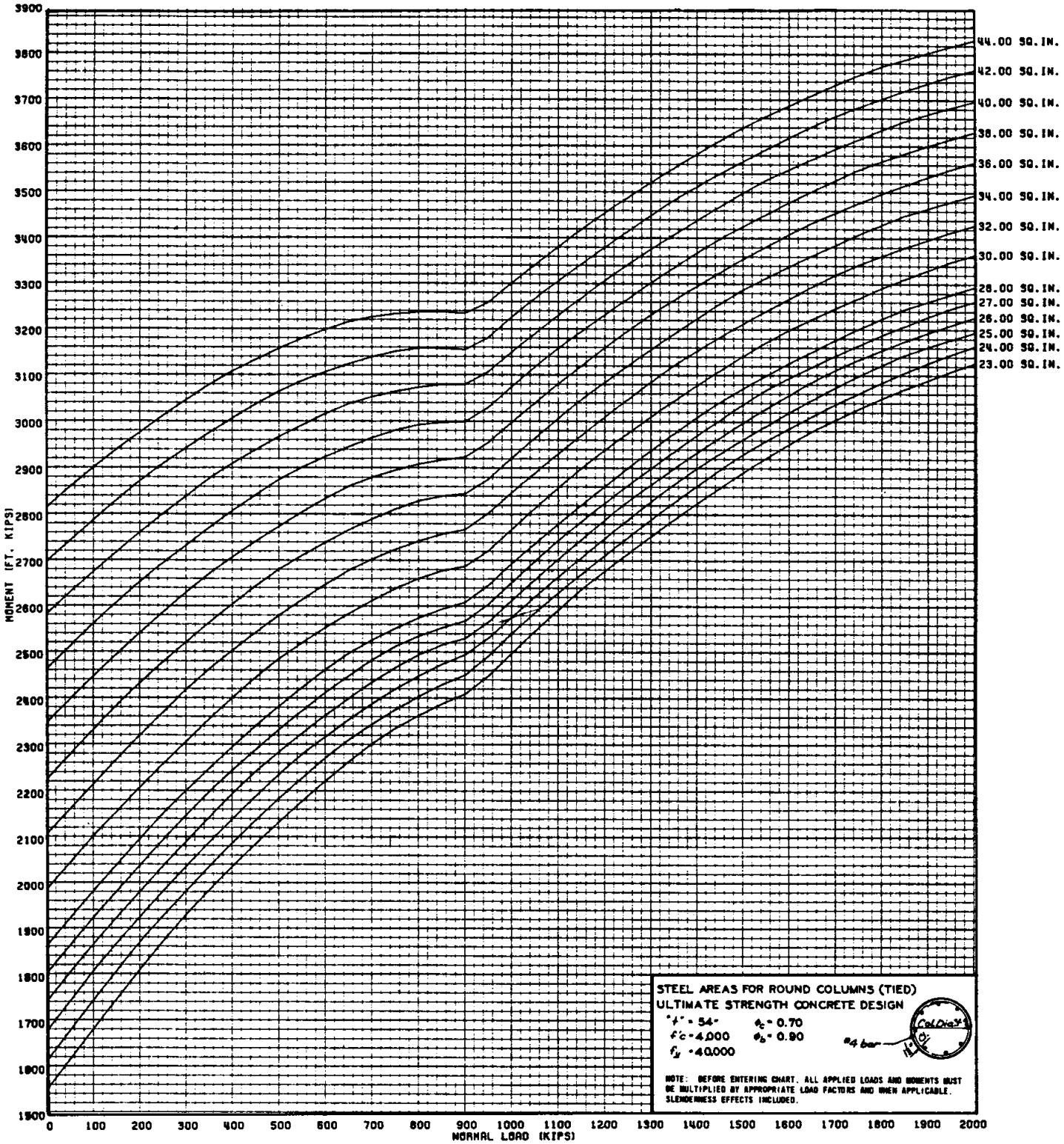
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.

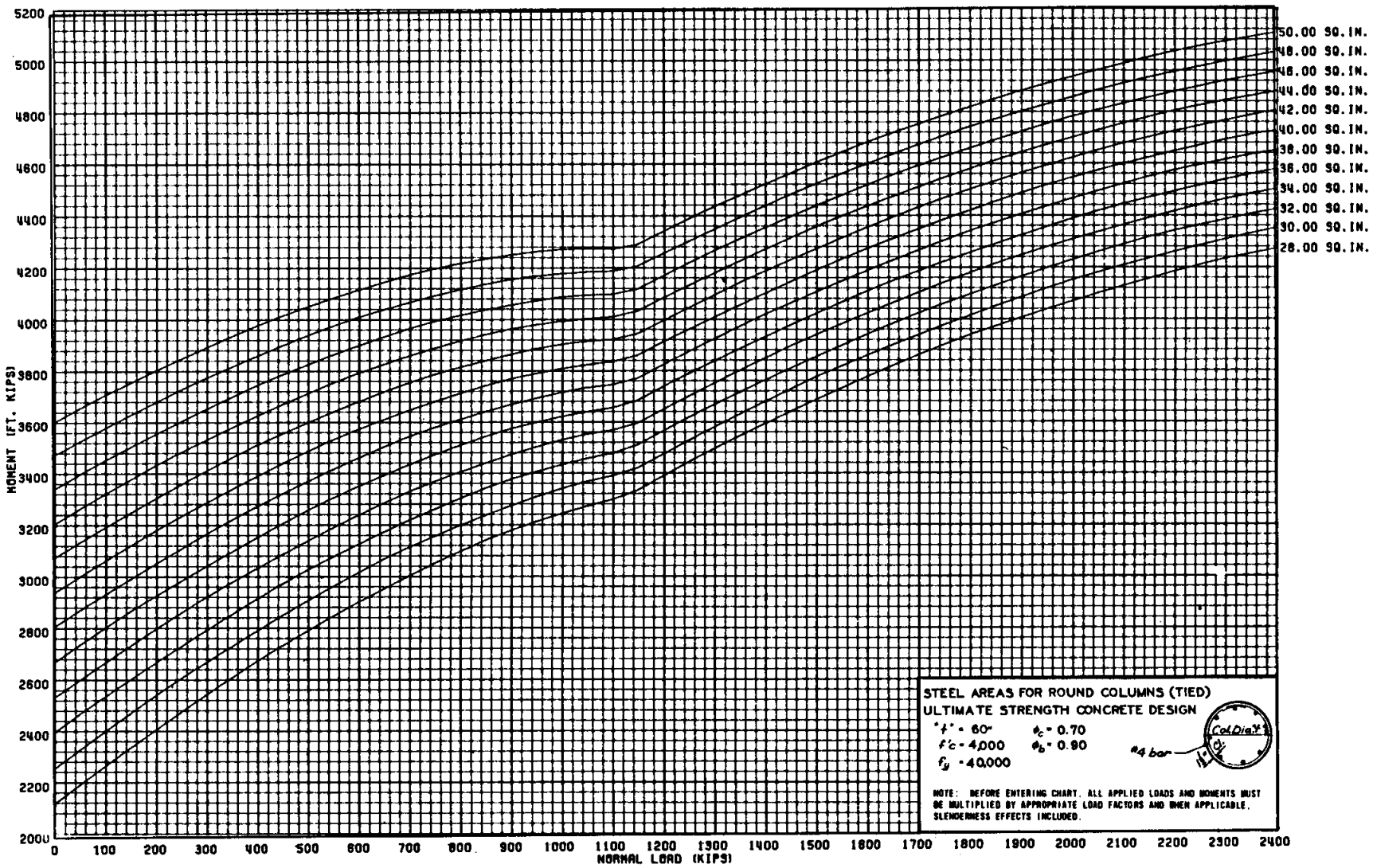

MOMENT (FT. KIPS)
800
750
700
650
600
550
500
450
400
350
300
250
200
0
100
200
300
400
500
600
700
800
900
1000
NORMAL LOAD (KIPS)
22.00 SQ.IN.
21.00 SQ.IN.
20.00 SQ.IN.
19.00 SQ.IN.
18.00 SQ.IN.
17.00 SQ.IN.
16.00 SQ.IN.
15.00 SQ.IN.
14.00 SQ.IN.
13.00 SQ.IN.
12.00 SQ.IN.
11.00 SQ.IN.
10.00 SQ.IN.
9.00 SQ.IN.
8.00 SQ.IN.
7.11 SQ.IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
"t" = 30"
f'c = 4,000
fy = 40,000
φc = 0.70
φb = 0.90
#4 bar
Col. Dia. "t"
Cl.
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED

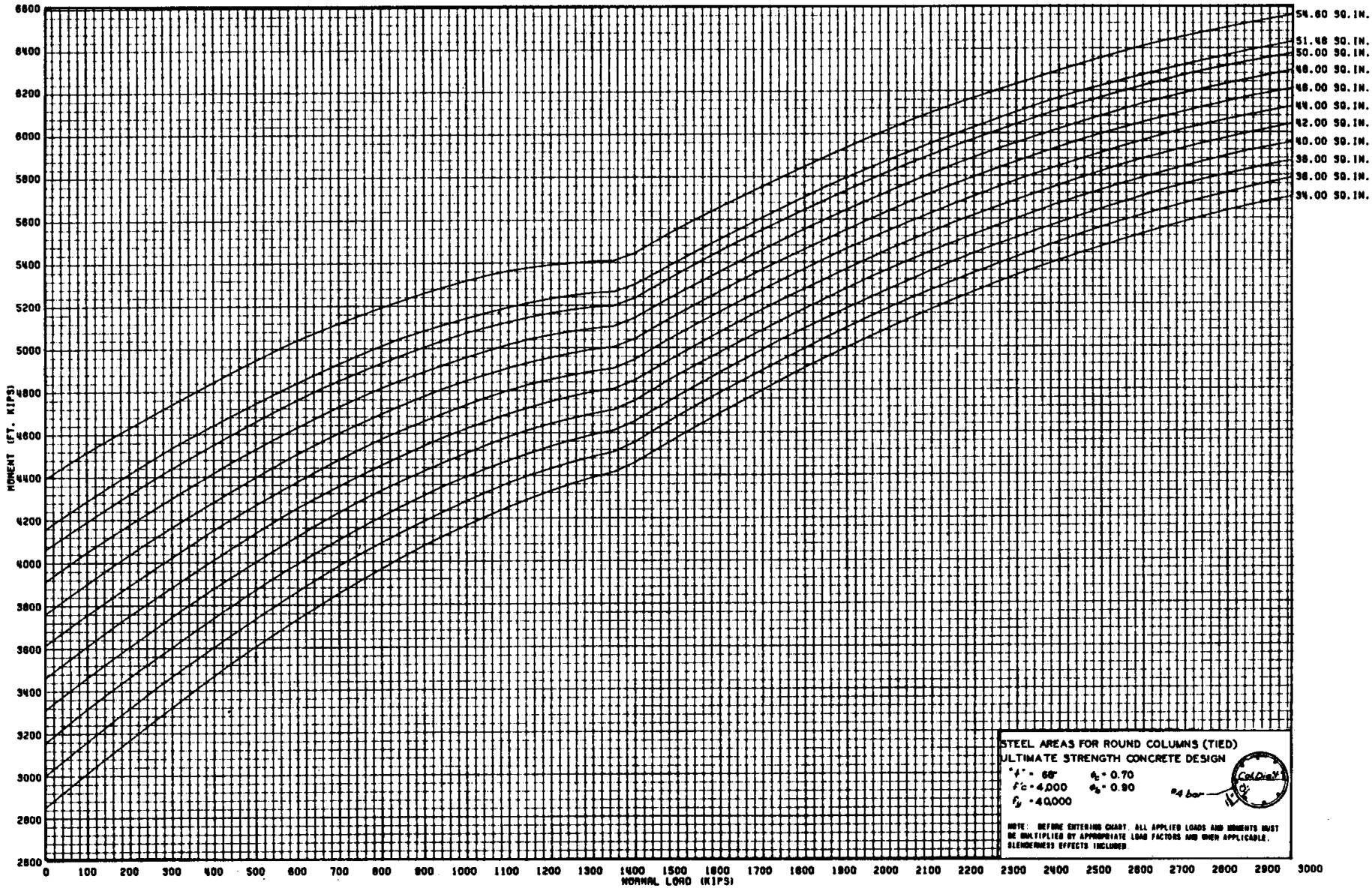

28.00 SQ.IN.
27.00 SQ.IN.
26.00 SQ.IN.
25.00 SQ.IN.
24.00 SQ.IN.
23.00 SQ.IN.
22.00 SQ.IN.
21.00 SQ.IN.
20.00 SQ.IN.
19.00 SQ.IN.
18.00 SQ.IN.
17.00 SQ.IN.
16.00 SQ.IN.
15.00 SQ.IN.
14.00 SQ.IN.
13.00 SQ.IN.
12.00 SQ.IN.
11.00 SQ.IN.
10.00 SQ.IN.
MOMENT (FT. KIPS)
400
450
500
550
600
650
700
750
800
850
900
950
1000
1050
1100
1150
1200
1250
1300
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
NORMAL LOAD (KIPS)
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
"t" = 36"
f'c = 4,000
fy = 40,000
φc = 0.70
φb = 0.90
Col.Dia.
#4 bar
NOTE: BEFORE ENTERING CHART. ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE. SLENDERNESS EFFECTS INCLUDED.

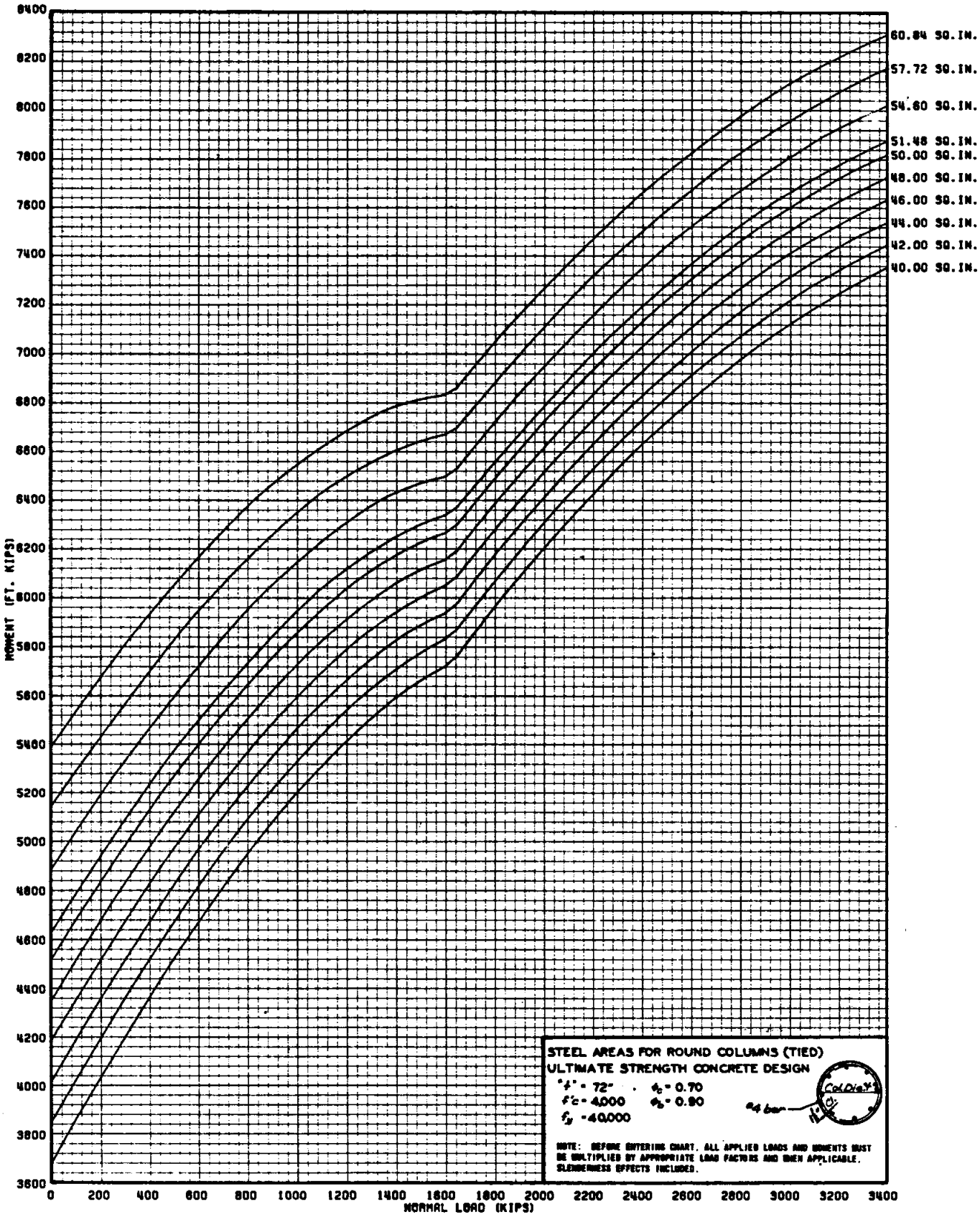

MOMENT (FT. KIPS)
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
NORMAL LOAD (KIPS)
33.00 SQ.IN.
32.00 SQ.IN.
31.00 SQ.IN.
30.00 SQ.IN.
29.00 SQ.IN.
28.00 SQ.IN.
27.00 SQ.IN.
26.00 SQ.IN.
25.00 SQ.IN.
24.00 SQ.IN.
23.00 SQ.IN.
22.00 SQ.IN.
21.00 SQ.IN.
20.00 SQ.IN.
19.00 SQ.IN.
18.00 SQ.IN.
17.00 SQ.IN.
16.00 SQ.IN.
15.00 SQ.IN.
14.00 SQ.IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
"t" = 42"
f'c = 4,000
fy = 40,000
φc = 0.70
φb = 0.90
#4 bar
Col. Dia. "t"
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.


39.00 SQ.IN
38.00 SQ.IN
36.00 SQ.IN
34.00 SQ.IN
32.00 SQ.IN
30.00 SQ.IN
28.00 SQ.IN
26.00 SQ.IN
25.00 SQ.IN
24.00 SQ.IN
23.00 SQ.IN
22.00 SQ.IN
21.00 SQ.IN
20.00 SQ.IN
19.00 SQ.IN
18.00 SQ.IN
MOMENT (FT. KIPS)
2900
2800
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
NORMAL LOAD (KIPS)
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
"t" = 48"
f'c = 4,000
fy = 40,000
φc = 0.70
φb = 0.90
#4 bar
Col. Dia. "t"
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.


44.00 SQ.IN.
42.00 SQ.IN.
40.00 SQ.IN.
38.00 SQ.IN.
36.00 SQ.IN.
34.00 SQ.IN.
32.00 SQ.IN.
30.00 SQ.IN.
28.00 SQ.IN.
27.00 SQ.IN.
26.00 SQ.IN.
25.00 SQ.IN.
24.00 SQ.IN.
23.00 SQ.IN.
MOMENT (FT. KIPS)
3900
3800
3700
3600
3500
3400
3300
3200
3100
3000
2900
2800
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
NORMAL LOAD (KIPS)
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
"t" = 54"
f'c = 4,000
fy = 40,000
φc = 0.70
φb = 0.90
#4 bar
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.


MOMENT (FT. KIPS)
5200
5000
4800
4600
4400
4200
4000
3800
3600
3400
3200
3000
2800
2600
2400
2200
2000
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
2100
2200
2300
2400
NORMAL LOAD (KIPS)
50.00 SQ.IN.
48.00 SQ.IN.
46.00 SQ.IN.
44.00 SQ.IN.
42.00 SQ.IN.
40.00 SQ.IN.
38.00 SQ.IN.
36.00 SQ.IN.
34.00 SQ.IN.
32.00 SQ.IN.
30.00 SQ.IN.
28.00 SQ.IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
"t" = 60"
f'c = 4,000
fy = 40,000
φc = 0.70
φb = 0.90
#4 bar
Col.Dia."t"
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.


MOMENT (FT. KIPS)
NORMAL LOAD (KIPS)
54.60 SQ.IN.
51.48 SQ.IN.
50.00 SQ.IN.
48.00 SQ.IN.
46.00 SQ.IN.
44.00 SQ.IN.
42.00 SQ.IN.
40.00 SQ.IN.
38.00 SQ.IN.
36.00 SQ.IN.
34.00 SQ.IN.
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
"d" = 68"
f'c = 4,000
fy = 40,000
φc = 0.70
φb = 0.90
#4 bar
Col. Diag.
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED


60.84 SQ.IN.
57.72 SQ.IN.
54.60 SQ.IN.
51.48 SQ.IN.
50.00 SQ.IN.
48.00 SQ.IN.
46.00 SQ.IN.
44.00 SQ.IN.
42.00 SQ.IN.
40.00 SQ.IN.
MOMENT (FT. KIPS)
NORMAL LOAD (KIPS)
STEEL AREAS FOR ROUND COLUMNS (TIED)
ULTIMATE STRENGTH CONCRETE DESIGN
"t" = 72" . ϕ_c = 0.70
f'c = 4,000 ϕ_b = 0.90
fy = 40,000
#4 bar
Col.Dia.
NOTE: BEFORE ENTERING CHART, ALL APPLIED LOADS AND MOMENTS MUST BE MULTIPLIED BY APPROPRIATE LOAD FACTORS AND WHEN APPLICABLE, SLENDERNESS EFFECTS INCLUDED.

MOMENT MAGNIFIER

MOMENT MAGNIFIER 'δ' FOR COLUMN DESIGN:

The attached sheets are design aid tables for estimating the moment magnifier for the design of columns.

The table for the correct column diameter is to be selected first.

k = See Section 3.71 for ℓu of columns 6'-0" or smaller diameter.

Bd = Sustained Load Factor

$$Bd = \frac{M(DL)}{M(TOTAL)}$$

Then give:
(a) Klu (ft.)
(b) Pu1 (kips) = Pu (1 + Bd)

Find: 'δ' (Moment Magnifier)

The tables are based on Ec of 3,321 ksi for F'c = 3,000 psi and Ec of 3,834 ksi for F'c = 4,000 psi concrete.

The formulae below are used to determine the following tables only.

$$Ig = \frac{\pi R^4}{4} \qquad \frac{klu}{r} > 22 \ \& \ \frac{klu}{r} < 100$$

R = Radius of Column r = Radius of Gyration = .25 (Col. Dia.)

$$(1+Bd)\ Pc = \frac{\pi^2 EcIg/2.5}{(klu)^2} = Pc1 \qquad Pc = \frac{Pc1}{1 + Bd}$$

$$'\delta' = \frac{1}{1 - \frac{Pu(1+Bd)}{\phi\ Pc1}} \geq 1.0$$

The term $\frac{Pu(1+Bd)}{\phi\ Pc1}$ in bent design is the average for all columns. The largest value of [P (1+Bd)] may be used for a conservative answer in selecting moment magnifier instead of average of columns.

A maximum value of 2.5 for moment magnifier is desirable for efficiency of design. Increase column diameter to reduce the magnifier, if necessary.

Select F'c = 4,000 psi concrete for columns 6'-0" or greater in diameter for the efficient use of concrete.

The tables are to be used to estimate the moment magnifier. Actual computations are required for columns greater than 6'-6" and are to be made from AASHTO design formulae.

Pc = Pc1/[1 + Bd] MOMENT MAGNIFIER 'S' 2'-6" COLUMN

F'c = 3,000 psi & Ec = 3,321 ksi Pu1 = (Pu x (1 + Bd))

Klu (ft)	Pc1 (Kips)	Pu1 200 S	Pu1 250 S	Pu1 300 S	Pu1 350 S	Pu1 400 S	Pu1 450 S	Pu1 500 S	Pu1 550 S	Pu1 600 S	Pu1 650 S	Pu1 700 S	Pu1 750 S	Pu1 800 S	Pu1 850 S	Pu1 900 S
12	25,140	1.01	1.01	1.02	1.02	1.02	1.03	1.03	1.03	1.04	1.04	1.04	1.04	1.05	1.05	1.05
14	18,470	1.02	1.02	1.02	1.03	1.03	1.04	1.04	1.04	1.05	1.05	1.06	1.06	1.07	1.07	1.07
16	14,141	1.02	1.03	1.03	1.04	1.04	1.05	1.05	1.06	1.06	1.07	1.08	1.08	1.09	1.09	1.10
18	11,173	1.03	1.03	1.04	1.05	1.05	1.06	1.07	1.08	1.08	1.09	1.10	1.11	1.11	1.12	1.13
20	9,050	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.10	1.11	1.12	1.13	1.14	1.15	1.17
22	7,480	1.04	1.05	1.06	1.07	1.08	1.09	1.11	1.12	1.13	1.14	1.15	1.17	1.18	1.19	1.21
24	6,285	1.05	1.06	1.07	1.09	1.10	1.11	1.13	1.14	1.16	1.17	1.19	1.21	1.22	1.24	1.26
26	5,355	1.06	1.07	1.09	1.10	1.12	1.14	1.15	1.17	1.19	1.21	1.23	1.25	1.27	1.29	1.32
28	4,617	1.07	1.08	1.10	1.12	1.14	1.16	1.18	1.21	1.23	1.25	1.28	1.30	1.33	1.36	1.39
30	4,022	1.08	1.10	1.12	1.14	1.17	1.19	1.22	1.24	1.27	1.30	1.33	1.36	1.40	1.43	1.47
32	3,535	1.09	1.11	1.14	1.16	1.19	1.22	1.25	1.29	1.32	1.36	1.39	1.43	1.48	1.52	1.57
34	3,132	1.10	1.13	1.16	1.19	1.22	1.26	1.30	1.33	1.38	1.42	1.47	1.52	1.57	1.63	1.70
36	2,793	1.11	1.15	1.18	1.22	1.26	1.30	1.34	1.39	1.44	1.50	1.56	1.62	1.69	1.77	1.85
38	2,507	1.13	1.17	1.21	1.25	1.30	1.34	1.40	1.46	1.52	1.59	1.66	1.75	1.84	1.94	2.05
40	2,263	1.14	1.19	1.23	1.28	1.34	1.40	1.46	1.53	1.61	1.70	1.79	1.90	2.02	2.16	2.32
42	2,052	1.16	1.21	1.26	1.32	1.39	1.46	1.53	1.62	1.72	1.83	1.95	2.09	2.26	2.45	2.68
44	1,870	1.18	1.24	1.30	1.36	1.44	1.52	1.62	1.72	1.85	1.99	2.15	2.34	2.57		
46	1,711	1.20	1.26	1.33	1.41	1.50	1.60	1.72	1.85	2.00	2.19	2.41	2.68			
48	1,571	1.22	1.29	1.38	1.47	1.57	1.69	1.83	2.00	2.20	2.44	2.75				
50	1,448	1.25	1.33	1.42	1.53	1.65	1.80	1.97	2.19	2.45	2.79					
52	1,339	1.27	1.36	1.47	1.60	1.74	1.92	2.14	2.42	2.78						
54	1,241	1.30	1.40	1.53	1.67	1.85	2.07	2.35	2.72							
56	1,154	1.33	1.45	1.59	1.76	1.98	2.26	2.62								
58	1,076	1.36	1.50	1.66	1.87	2.13	2.48	2.97								
60	1,006	1.40	1.55	1.74	1.99	2.32	2.77									
62	942	1.44	1.61	1.84	2.13	2.54										

Maximum kl_u value=62.5 that may be used on 2'-6" column.

Pc = Pc1/[1 + Bd] MOMENT MAGNIFIER 'S' 3'-0" COLUMN
F'c = 3,000 psi & Ec = 3,321 ksi Pul = (Pu x (1 + Bd))

Klu (ft)	Pc_1 (Kips)	Pul 300 S	Pul 350 S	Pul 400 S	Pul 450 S	Pul 500 S	Pul 550 S	Pul 600 S	Pul 650 S	Pul 700 S	Pul 750 S	Pul 800 S	Pul 850 S	Pul 900 S	Pul 950 S	Pul 1000 S
16	29,323	1.01	1.02	1.02	1.02	1.02	1.03	1.03	1.03	1.04	1.04	1.04	1.04	1.05	1.05	1.05
18	23,169	1.02	1.02	1.03	1.03	1.04	1.04	1.04	1.04	1.05	1.05	1.05	1.06	1.06	1.06	1.07
20	18,767	1.02	1.03	1.03	1.04	1.04	1.04	1.05	1.05	1.06	1.06	1.06	1.07	1.07	1.08	1.08
22	15,510	1.03	1.03	1.04	1.04	1.05	1.05	1.06	1.06	1.07	1.07	1.08	1.08	1.09	1.10	1.10
24	13,032	1.03	1.04	1.05	1.05	1.06	1.06	1.07	1.08	1.08	1.09	1.10	1.10	1.11	1.12	1.12
26	11,105	1.04	1.05	1.05	1.06	1.07	1.08	1.08	1.09	1.10	1.11	1.11	1.12	1.13	1.14	1.15
28	9,575	1.05	1.06	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18
30	8,341	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.21
32	7,331	1.06	1.07	1.08	1.10	1.11	1.12	1.13	1.15	1.16	1.17	1.18	1.20	1.21	1.23	1.24
34	6,494	1.07	1.08	1.10	1.11	1.12	1.14	1.15	1.17	1.18	1.20	1.21	1.23	1.25	1.26	1.28
36	5,792	1.08	1.09	1.11	1.12	1.14	1.16	1.17	1.19	1.21	1.23	1.25	1.27	1.29	1.31	1.33
38	5,199	1.09	1.11	1.12	1.14	1.16	1.18	1.20	1.22	1.24	1.26	1.28	1.30	1.33	1.35	1.38
40	4,692	1.10	1.12	1.14	1.16	1.18	1.20	1.22	1.25	1.27	1.30	1.32	1.35	1.38	1.41	1.44
42	4,255	1.11	1.13	1.16	1.18	1.20	1.23	1.25	1.28	1.31	1.34	1.37	1.40	1.43	1.47	1.51
44	3,877	1.12	1.15	1.17	1.20	1.23	1.25	1.28	1.31	1.35	1.38	1.42	1.46	1.50	1.54	1.58
46	3,548	1.14	1.16	1.19	1.22	1.25	1.28	1.32	1.35	1.39	1.43	1.48	1.52	1.57	1.62	1.67
48	3,258	1.15	1.18	1.21	1.25	1.28	1.32	1.36	1.40	1.44	1.49	1.54	1.59	1.65	1.71	1.78
50	3,003	1.17	1.20	1.24	1.27	1.31	1.35	1.40	1.45	1.50	1.55	1.61	1.68	1.75	1.82	1.91
52	2,776	1.18	1.22	1.26	1.30	1.35	1.39	1.45	1.50	1.56	1.63	1.70	1.78	1.86	1.96	2.06
54	2,574	1.20	1.24	1.29	1.33	1.38	1.44	1.50	1.56	1.64	1.71	1.80	1.89	2.00	2.12	2.25
56	2,394	1.22	1.26	1.31	1.37	1.43	1.49	1.56	1.63	1.72	1.81	1.91	2.03	2.16	2.31	2.48
58	2,231	1.24	1.29	1.34	1.40	1.47	1.54	1.62	1.71	1.81	1.92	2.05	2.19	2.36	2.55	
60	2,085	1.26	1.32	1.38	1.45	1.52	1.60	1.70	1.80	1.92	2.06	2.21	2.39	2.61		
62	1,953	1.28	1.34	1.41	1.49	1.58	1.67	1.78	1.91	2.05	2.22	2.41	2.64			
64	1,833	1.31	1.38	1.45	1.54	1.64	1.75	1.88	2.03	2.20	2.41	2.66				
66	1,723	1.33	1.41	1.50	1.60	1.71	1.84	1.99	2.17	2.38	2.64					
68	1,623	1.36	1.45	1.54	1.66	1.79	1.94	2.12	2.34	2.60						
70	1,532	1.39	1.48	1.59	1.72	1.87	2.05	2.27	2.54							
72	1,448	1.42	1.53	1.65	1.80	1.97	2.19	2.45	2.79							
74	1,371	1.45	1.57	1.71	1.88	2.09	2.34	2.67								

Maximum kl_u value=75 that may be used on 3'-0" column.

Pc = Pc1/[1 + Bd] MOMENT MAGNIFIER 'S' 3'-6" COLUMN

F'c = 3,000 psi & Ec = 3,321 ksi Pul = (Pu x (1 + Bd))

Klu (ft)	Pc_1 (Kips)	Pul 400 S	Pul 450 S	Pul 500 S	Pul 550 S	Pul 600 S	Pul 650 S	Pul 700 S	Pul 750 S	Pul 800 S	Pul 850 S	Pul 900 S	Pul 950 S	Pul 1000 S	Pul 1050 S	Pul 1100 S
30	15,452	1.04	1.04	1.05	1.05	1.06	1.06	1.07	1.07	1.08	1.09	1.09	1.10	1.10	1.11	1.11
32	13,581	1.04	1.05	1.06	1.06	1.07	1.07	1.08	1.09	1.09	1.10	1.10	1.11	1.12	1.12	1.13
34	12,030	1.05	1.06	1.06	1.07	1.08	1.08	1.09	1.10	1.10	1.11	1.12	1.13	1.13	1.14	1.15
36	10,730	1.06	1.06	1.07	1.08	1.09	1.09	1.10	1.11	1.12	1.13	1.14	1.14	1.15	1.16	1.17
38	9,630	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.13	1.14	1.15	1.16	1.17	1.18	1.19
40	8,692	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.19	1.20	1.21	1.22
42	7,884	1.08	1.09	1.10	1.11	1.12	1.13	1.15	1.16	1.17	1.18	1.19	1.21	1.22	1.23	1.25
44	7,183	1.09	1.10	1.11	1.12	1.14	1.15	1.16	1.18	1.19	1.20	1.22	1.23	1.25	1.26	1.28
46	6,572	1.10	1.11	1.12	1.14	1.15	1.16	1.18	1.19	1.21	1.23	1.24	1.26	1.28	1.30	1.31
48	6,036	1.10	1.12	1.13	1.15	1.17	1.18	1.20	1.21	1.23	1.25	1.27	1.29	1.31	1.33	1.35
50	5,563	1.11	1.13	1.15	1.16	1.18	1.20	1.22	1.24	1.26	1.28	1.30	1.32	1.35	1.37	1.39
52	5,143	1.12	1.14	1.16	1.18	1.20	1.22	1.24	1.26	1.29	1.31	1.33	1.36	1.38	1.41	1.44
54	4,769	1.14	1.16	1.18	1.20	1.22	1.24	1.27	1.29	1.32	1.34	1.37	1.40	1.43	1.46	1.49
56	4,435	1.15	1.17	1.19	1.22	1.24	1.26	1.29	1.32	1.35	1.38	1.41	1.44	1.48	1.51	1.55
58	4,134	1.16	1.18	1.21	1.23	1.26	1.29	1.32	1.34	1.38	1.42	1.45	1.49	1.53	1.57	1.61
60	3,863	1.17	1.20	1.23	1.26	1.29	1.32	1.35	1.38	1.42	1.46	1.50	1.54	1.60	1.63	1.69
62	3,618	1.19	1.22	1.25	1.28	1.31	1.35	1.38	1.42	1.46	1.51	1.55	1.60	1.65	1.71	1.77
64	3,395	1.20	1.23	1.27	1.30	1.34	1.38	1.42	1.46	1.51	1.56	1.61	1.67	1.73	1.79	1.86
66	3,193	1.22	1.25	1.29	1.33	1.37	1.41	1.46	1.51	1.56	1.61	1.67	1.74	1.81	1.89	1.97
68	3,008	1.23	1.27	1.31	1.35	1.40	1.45	1.50	1.55	1.61	1.68	1.75	1.82	1.90	1.99	2.09
70	2,838	1.25	1.29	1.34	1.38	1.43	1.49	1.54	1.61	1.67	1.75	1.83	1.92	2.01	2.12	2.24
72	2,683	1.27	1.32	1.36	1.41	1.47	1.53	1.59	1.66	1.74	1.83	1.92	2.02	2.14	2.27	2.41
74	2,540	1.29	1.34	1.39	1.45	1.51	1.58	1.65	1.73	1.82	1.92	2.03	2.15	2.29	2.44	2.62
76	2,408	1.31	1.36	1.42	1.48	1.55	1.63	1.71	1.80	1.90	2.02	2.15	2.29	2.46	2.65	
78	2,286	1.33	1.39	1.45	1.52	1.60	1.68	1.78	1.88	2.00	2.13	2.29	2.46	2.67		
80	2,173	1.36	1.42	1.49	1.57	1.65	1.75	1.85	1.97	2.11	2.27	2.45	2.66			
82	2,068	1.38	1.45	1.52	1.61	1.71	1.81	1.94	2.07	2.23	2.42	2.64				
84	1,971	1.41	1.48	1.57	1.66	1.77	1.89	2.03	2.19	2.38	2.60					
86	1,880	1.44	1.52	1.61	1.72	1.84	1.98	2.14	2.32	2.55						

Maximum kl_u value=87.5 that may be used on 3'-6" column.

MOMENT MAGNIFIER 'S' 4'-0" COLUMN

$Pc = Pc1/[1 + Bd]$ $\quad$ $Pu1 = (Pu \times (1 + Bd))$

$F'c = 3{,}000$ psi & $Ec = 3{,}321$ ksi

Klu (ft)	Pc_1 (Kips)	Pu1 500 S	Pu1 550 S	Pu1 600 S	Pu1 650 S	Pu1 700 S	Pu1 750 S	Pu1 800 S	Pu1 850 S	Pu1 900 S	Pu1 950 S	Pu1 1000 S	Pu1 1050 S	Pu1 1100 S	Pu1 1150 S	Pu1 1200 S
40	14,828	1.05	1.06	1.06	1.07	1.07	1.08	1.08	1.09	1.09	1.10	1.11	1.11	1.12	1.12	1.13
42	13,449	1.06	1.06	1.07	1.07	1.08	1.09	1.09	1.10	1.11	1.11	1.12	1.13	1.13	1.14	1.15
44	12,255	1.06	1.07	1.08	1.08	1.09	1.10	1.10	1.11	1.12	1.12	1.13	1.14	1.15	1.15	1.16
46	11,212	1.07	1.08	1.08	1.09	1.10	1.11	1.11	1.12	1.13	1.14	1.15	1.15	1.16	1.17	1.18
48	10,297	1.07	1.08	1.09	1.10	1.11	1.12	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20
50	9,490	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22
52	8,774	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.21	1.22	1.23	1.24
54	8,136	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.18	1.19	1.20	1.21	1.23	1.24	1.25	1.27
56	7,565	1.10	1.12	1.13	1.14	1.15	1.16	1.18	1.19	1.20	1.22	1.23	1.25	1.26	1.28	1.29
58	7,053	1.11	1.13	1.14	1.15	1.17	1.18	1.19	1.21	1.22	1.24	1.25	1.27	1.29	1.30	1.32
60	6,590	1.12	1.14	1.15	1.16	1.18	1.19	1.21	1.23	1.24	1.26	1.28	1.29	1.31	1.33	1.35
62	6,172	1.13	1.15	1.16	1.18	1.19	1.21	1.23	1.24	1.26	1.28	1.30	1.32	1.34	1.36	1.38
64	5,792	1.14	1.16	1.17	1.19	1.21	1.23	1.25	1.27	1.29	1.31	1.33	1.35	1.37	1.40	1.42
66	5,446	1.15	1.17	1.19	1.21	1.22	1.24	1.27	1.29	1.31	1.33	1.36	1.38	1.41	1.43	1.46
68	5,131	1.16	1.18	1.20	1.22	1.24	1.26	1.29	1.31	1.33	1.36	1.39	1.41	1.44	1.47	1.50
70	4,842	1.17	1.19	1.22	1.24	1.26	1.28	1.31	1.33	1.36	1.39	1.42	1.45	1.48	1.51	1.55
72	4,577	1.18	1.21	1.23	1.25	1.28	1.31	1.33	1.36	1.39	1.42	1.45	1.49	1.52	1.56	1.60
74	4,332	1.20	1.22	1.25	1.27	1.30	1.33	1.36	1.39	1.42	1.46	1.49	1.53	1.57	1.61	1.65
76	4,107	1.21	1.24	1.26	1.29	1.32	1.35	1.39	1.42	1.46	1.49	1.53	1.58	1.62	1.67	1.72
78	3,900	1.22	1.25	1.28	1.31	1.34	1.38	1.41	1.45	1.49	1.53	1.58	1.63	1.67	1.73	1.78
80	3,707	1.24	1.27	1.30	1.33	1.37	1.41	1.45	1.49	1.53	1.58	1.63	1.68	1.74	1.80	1.86
82	3,528	1.25	1.29	1.32	1.36	1.40	1.44	1.48	1.52	1.57	1.63	1.68	1.74	1.80	1.87	1.94
84	3,362	1.27	1.30	1.34	1.38	1.42	1.47	1.51	1.57	1.62	1.68	1.74	1.81	1.88	1.96	2.04
86	3,208	1.29	1.32	1.36	1.41	1.45	1.50	1.55	1.61	1.67	1.73	1.80	1.88	1.96	2.05	2.15
88	3,064	1.30	1.34	1.39	1.43	1.48	1.54	1.60	1.66	1.72	1.80	1.87	1.96	2.05	2.16	2.27
90	2,929	1.32	1.37	1.41	1.46	1.52	1.58	1.64	1.71	1.78	1.86	1.95	2.05	2.16	2.28	2.41
92	2,803	1.34	1.39	1.44	1.50	1.55	1.62	1.69	1.76	1.85	1.94	2.04	2.15	2.28	2.42	2.57
94	2,685	1.36	1.41	1.47	1.53	1.59	1.66	1.74	1.83	1.92	2.02	2.14	2.27	2.41	2.58	
96	2,574	1.38	1.44	1.50	1.56	1.64	1.71	1.80	1.89	2.00	2.12	2.25	2.40	2.57		
98	2,470	1.41	1.47	1.53	1.60	1.68	1.77	1.86	1.97	2.09	2.22	2.37	2.55			
100	2,372	1.43	1.50	1.57	1.64	1.73	1.82	1.93	2.05	2.18	2.34	2.51				

Maximum kl_u value=100 that may be used on 4'-0" column.

Pc = Pc1/[1 + Bd] MOMENT MAGNIFIER 'S' 4'-6" COLUMN

F'c = 3,000 psi & Ec = 3,321 ksi Pu1 = (Pu x (1 + Bd))

Klu (ft)	Pc_1 (Kips)	Pu1 700 S	Pu1 750 S	Pu1 800 S	Pu1 850 S	Pu1 900 S	Pu1 950 S	Pu1 1000 S	Pu1 1050 S	Pu1 1100 S	Pu1 1150 S	Pu1 1200 S	Pu1 1250 S	Pu1 1300 S	Pu1 1350 S	Pu1 1400 S
50	15,201	1.07	1.08	1.08	1.09	1.09	1.10	1.10	1.11	1.12	1.12	1.13	1.13	1.14	1.15	1.15
52	14,054	1.08	1.08	1.09	1.09	1.10	1.11	1.11	1.12	1.13	1.14	1.15	1.15	1.15	1.16	1.17
54	13,032	1.08	1.09	1.10	1.10	1.11	1.12	1.12	1.13	1.14	1.14	1.15	1.16	1.17	1.17	1.18
56	12,118	1.09	1.10	1.10	1.11	1.12	1.13	1.13	1.14	1.15	1.16	1.16	1.17	1.18	1.19	1.20
58	11,296	1.10	1.10	1.11	1.12	1.13	1.14	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22
60	10,556	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.17	1.18	1.19	1.20	1.21	1.22	1.23
62	9,886	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25
64	9,278	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.22	1.23	1.24	1.25	1.26	1.27
66	8,724	1.13	1.14	1.15	1.16	1.17	1.18	1.20	1.21	1.22	1.23	1.24	1.26	1.27	1.28	1.30
68	8,219	1.14	1.15	1.16	1.17	1.19	1.20	1.21	1.22	1.24	1.25	1.26	1.28	1.29	1.31	1.32
70	7,756	1.15	1.16	1.17	1.19	1.20	1.21	1.23	1.24	1.25	1.27	1.28	1.30	1.31	1.33	1.35
72	7,331	1.16	1.17	1.18	1.20	1.21	1.23	1.24	1.26	1.27	1.29	1.31	1.32	1.34	1.36	1.38
74	6,940	1.17	1.18	1.20	1.21	1.23	1.24	1.26	1.28	1.29	1.31	1.33	1.35	1.37	1.38	1.40
76	6,579	1.18	1.19	1.21	1.23	1.24	1.26	1.28	1.30	1.31	1.33	1.35	1.37	1.39	1.41	1.44
78	6,246	1.19	1.21	1.22	1.24	1.26	1.28	1.30	1.32	1.34	1.36	1.38	1.40	1.42	1.45	1.47
80	5,938	1.20	1.22	1.24	1.26	1.28	1.30	1.32	1.34	1.36	1.38	1.41	1.43	1.46	1.48	1.51
82	5,652	1.21	1.23	1.25	1.27	1.29	1.32	1.34	1.36	1.39	1.41	1.44	1.46	1.49	1.52	1.55
84	5,386	1.23	1.25	1.27	1.29	1.31	1.34	1.36	1.39	1.41	1.44	1.47	1.50	1.53	1.56	1.59
86	5,138	1.24	1.26	1.29	1.31	1.33	1.36	1.39	1.41	1.44	1.47	1.50	1.53	1.57	1.60	1.64
88	4,907	1.26	1.28	1.30	1.33	1.36	1.38	1.41	1.44	1.47	1.50	1.54	1.57	1.61	1.65	1.69
90	4,692	1.27	1.30	1.32	1.35	1.38	1.41	1.44	1.47	1.50	1.54	1.58	1.61	1.66	1.70	1.74
92	4,490	1.29	1.31	1.34	1.37	1.40	1.43	1.47	1.50	1.54	1.58	1.62	1.66	1.71	1.75	1.80
94	4,301	1.30	1.33	1.36	1.39	1.43	1.46	1.50	1.54	1.58	1.62	1.66	1.71	1.76	1.81	1.87
96	4,123	1.32	1.35	1.38	1.42	1.45	1.49	1.53	1.57	1.62	1.66	1.71	1.76	1.82	1.88	1.94
98	3,957	1.34	1.37	1.41	1.44	1.48	1.52	1.57	1.61	1.66	1.71	1.76	1.82	1.88	1.95	2.02
100	3,800	1.36	1.39	1.43	1.47	1.51	1.56	1.60	1.65	1.71	1.76	1.82	1.89	1.96	2.03	2.11
102	3,653	1.38	1.42	1.46	1.50	1.54	1.59	1.64	1.70	1.76	1.82	1.88	1.96	2.03	2.12	2.21
104	3,514	1.40	1.44	1.48	1.53	1.58	1.63	1.69	1.74	1.81	1.88	1.95	2.03	2.12	2.22	2.32
106	3,382	1.42	1.47	1.51	1.56	1.61	1.67	1.73	1.80	1.87	1.94	2.02	2.11	2.22	2.33	2.45
108	3,258	1.44	1.49	1.54	1.59	1.65	1.71	1.78	1.85	1.93	2.02	2.11	2.21	2.33	2.45	2.59
110	3,141	1.47	1.52	1.57	1.63	1.69	1.76	1.83	1.91	2.00	2.10	2.20	2.32	2.45	2.59	

	Pc = Pc1/[1 + Bd] F'c = 3,000 psi & Ec = 3,321 ksi	MOMENT MAGNIFIER 'S' 4'-6" COLUMN (CON'T.) Pu1 = (Pu x (1 + Bd))														
Klu (ft)	Pc_1 (Kips)	Pu1 700 S	Pu1 750 S	Pu1 800 S	Pu1 850 S	Pu1 900 S	Pu1 950 S	Pu1 1000 S	Pu1 1050 S	Pu1 1100 S	Pu1 1150 S	Pu1 1200 S	Pu1 1250 S	Pu1 1300 S	Pu1 1350 S	Pu1 1400 S
112	3,030	1.49	1.55	1.61	1.67	1.74	1.81	1.89	1.98	2.08	2.18	2.30	2.44	2.58		

Maximum kl_u value=112.5 that may be used on 4'-6" column.

Pc = Pc1/[1 + Bd] MOMENT MAGNIFIER 'δ' 5'-0" COLUMN

F'c = 3,000 psi & Ec = 3,321 ksi Pu1 = (Pu x (1 + Bd))

Klu (ft)	Pc_1 (Kips)	Pu1 400 δ	Pu1 500 δ	Pu1 600 δ	Pu1 700 δ	Pu1 800 δ	Pu1 900 δ	Pu1 1000 δ	Pu1 1100 δ	Pu1 1200 δ	Pu1 1300 δ	Pu1 1400 δ	Pu1 1500 δ	Pu1 1600 δ	Pu1 1700 δ	Pu1 1800 δ
60	16,089	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.17	1.18	1.19
62	15,068	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.12	1.13	1.14	1.15	1.17	1.18	1.19	1.21
64	14,141	1.04	1.05	1.06	1.08	1.09	1.10	1.11	1.13	1.14	1.15	1.16	1.18	1.19	1.21	1.22
66	13,297	1.04	1.06	1.07	1.08	1.09	1.11	1.12	1.13	1.15	1.16	1.18	1.19	1.21	1.22	1.24
68	12,526	1.05	1.06	1.07	1.09	1.10	1.11	1.13	1.14	1.16	1.17	1.19	1.21	1.22	1.24	1.26
70	11,821	1.05	1.06	1.08	1.09	1.11	1.12	1.14	1.15	1.17	1.19	1.20	1.22	1.24	1.26	1.28
72	11,173	1.05	1.07	1.08	1.10	1.11	1.13	1.15	1.16	1.18	1.20	1.22	1.24	1.26	1.28	1.30
74	10,577	1.06	1.07	1.09	1.10	1.12	1.14	1.16	1.17	1.19	1.21	1.23	1.25	1.28	1.30	1.32
76	10,028	1.06	1.08	1.09	1.11	1.13	1.15	1.17	1.19	1.21	1.23	1.25	1.27	1.30	1.32	1.34
78	9,520	1.06	1.08	1.10	1.12	1.14	1.16	1.18	1.20	1.22	1.24	1.27	1.29	1.32	1.34	1.37
80	9,050	1.07	1.09	1.10	1.12	1.14	1.17	1.19	1.21	1.23	1.26	1.28	1.31	1.34	1.37	1.40
82	8,614	1.07	1.09	1.11	1.13	1.15	1.18	1.20	1.22	1.25	1.27	1.30	1.33	1.36	1.39	1.43
84	8,209	1.07	1.10	1.12	1.14	1.16	1.19	1.21	1.24	1.26	1.29	1.32	1.35	1.39	1.42	1.46
86	7,831	1.08	1.10	1.12	1.15	1.17	1.20	1.22	1.25	1.28	1.31	1.34	1.38	1.41	1.45	1.49
88	7,480	1.08	1.11	1.13	1.15	1.18	1.21	1.24	1.27	1.30	1.33	1.36	1.40	1.44	1.48	1.52
90	7,151	1.09	1.11	1.14	1.16	1.19	1.22	1.25	1.28	1.32	1.35	1.39	1.43	1.47	1.51	1.56
92	6,843	1.09	1.12	1.14	1.17	1.20	1.23	1.26	1.30	1.33	1.37	1.41	1.46	1.50	1.55	1.60
94	6,555	1.10	1.12	1.15	1.18	1.21	1.24	1.28	1.32	1.35	1.40	1.44	1.49	1.54	1.59	1.65
96	6,285	1.10	1.13	1.16	1.19	1.22	1.26	1.29	1.33	1.38	1.42	1.47	1.52	1.57	1.63	1.69
98	6,031	1.10	1.13	1.17	1.20	1.23	1.27	1.31	1.35	1.40	1.44	1.50	1.55	1.61	1.67	1.74
100	5,792	1.11	1.14	1.17	1.21	1.25	1.29	1.33	1.37	1.42	1.47	1.53	1.59	1.65	1.72	1.80
102	5,567	1.11	1.15	1.18	1.22	1.26	1.30	1.35	1.39	1.44	1.50	1.56	1.63	1.70	1.77	1.86
104	5,355	1.12	1.15	1.19	1.23	1.27	1.32	1.36	1.42	1.47	1.53	1.60	1.67	1.74	1.83	1.92
106	5,155	1.12	1.16	1.20	1.24	1.28	1.33	1.38	1.44	1.50	1.56	1.63	1.71	1.80	1.89	1.99
108	4,966	1.13	1.17	1.21	1.25	1.30	1.35	1.40	1.46	1.53	1.60	1.67	1.76	1.85	1.96	2.07
110	4,787	1.14	1.18	1.22	1.26	1.31	1.37	1.43	1.49	1.56	1.63	1.72	1.81	1.91	2.03	2.16
112	4,617	1.14	1.18	1.23	1.28	1.33	1.39	1.45	1.52	1.59	1.67	1.76	1.87	1.98	2.11	2.26
114	4,457	1.15	1.19	1.24	1.29	1.34	1.41	1.47	1.54	1.63	1.71	1.81	1.93	2.05	2.20	2.36
116	4,305	1.15	1.20	1.25	1.30	1.36	1.43	1.50	1.57	1.66	1.76	1.87	1.99	2.13	2.29	2.48
118	4,160	1.16	1.21	1.26	1.32	1.38	1.45	1.52	1.61	1.70	1.81	1.93	2.06	2.22	2.40	2.62
120	4,022	1.17	1.22	1.27	1.33	1.40	1.47	1.55	1.64	1.74	1.86	1.99	2.14	2.32	2.52	

	Pc = Pc1/[1 + Bd] F'c = 3,000 psi & Ec = 3,321 ksi																MOMENT MAGNIFIER 'S' 5'-0" COLUMN (CON'T.) Pu1 = (Pu x (1 + Bd))
Klu (ft)	Pc_1 (Kips)	Pu1 400 S	Pu1 500 S	Pu1 600 S	Pu1 700 S	Pu1 800 S	Pu1 900 S	Pu1 1000 S	Pu1 1100 S	Pu1 1200 S	Pu1 1300 S	Pu1 1400 S	Pu1 1500 S	Pu1 1600 S	Pu1 1700 S	Pu1 1800 S
122	3,892	1.17	1.22	1.28	1.35	1.42	1.49	1.58	1.68	1.79	1.91	2.06	2.23	2.42	2.66	
124	3,767	1.18	1.23	1.29	1.36	1.44	1.52	1.61	1.72	1.84	1.97	2.13	2.32	2.54		

Maximum kl_u value=125 that may be used on 5'-0" column.

Pc = Pc1/[1 + Bd] MOMENT MAGNIFIER 'δ' 5'-6" COLUMN

F'c = 3,000 psi & Ec = 3,321 ksi Pul = (Pu x (1 + Bd))

Klu (ft)	Pc_1 (Kips)	Pul 800 δ	Pul 900 δ	Pul 1000 δ	Pul 1100 δ	Pul 1200 δ	Pul 1300 δ	Pul 1400 δ	Pul 1500 δ	Pul 1600 δ	Pul 1700 δ	Pul 1800 δ	Pul 1900 δ	Pul 2000 δ	Pul 2100 δ	Pul 2200 δ
70	17,307	1.07	1.08	1.09	1.10	1.10	1.12	1.13	1.14	1.15	1.16	1.17	1.19	1.20	1.21	1.22
72	16,359	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.19	1.20	1.21	1.22	1.24
74	15,486	1.08	1.09	1.10	1.11	1.12	1.14	1.15	1.16	1.17	1.19	1.20	1.21	1.23	1.24	1.25
76	14,682	1.08	1.10	1.11	1.12	1.13	1.14	1.16	1.17	1.18	1.20	1.21	1.23	1.24	1.26	1.27
78	13,939	1.09	1.10	1.11	1.13	1.14	1.15	1.17	1.18	1.20	1.21	1.23	1.24	1.26	1.27	1.29
80	13,250	1.09	1.11	1.12	1.13	1.15	1.16	1.18	1.19	1.21	1.22	1.24	1.26	1.27	1.29	1.31
82	12,612	1.10	1.11	1.13	1.14	1.16	1.17	1.19	1.20	1.22	1.24	1.26	1.27	1.29	1.31	1.33
84	12,019	1.11	1.12	1.13	1.15	1.17	1.18	1.20	1.22	1.23	1.25	1.27	1.29	1.31	1.33	1.35
86	11,466	1.11	1.13	1.14	1.16	1.18	1.19	1.21	1.23	1.25	1.27	1.29	1.31	1.33	1.35	1.38
88	10,951	1.12	1.13	1.15	1.17	1.19	1.20	1.22	1.24	1.26	1.28	1.31	1.33	1.35	1.38	1.40
90	10,470	1.12	1.14	1.16	1.18	1.20	1.22	1.24	1.26	1.28	1.30	1.33	1.35	1.38	1.40	1.43
92	10,019	1.13	1.15	1.17	1.19	1.21	1.23	1.25	1.27	1.30	1.32	1.35	1.37	1.40	1.43	1.46
94	9,597	1.14	1.15	1.17	1.20	1.22	1.24	1.26	1.29	1.31	1.34	1.37	1.39	1.42	1.45	1.49
96	9,202	1.14	1.16	1.18	1.21	1.23	1.25	1.28	1.30	1.33	1.36	1.39	1.42	1.45	1.48	1.52
98	8,830	1.15	1.17	1.19	1.22	1.24	1.27	1.29	1.32	1.35	1.38	1.41	1.44	1.48	1.51	1.55
100	8,480	1.16	1.18	1.20	1.23	1.25	1.28	1.31	1.34	1.37	1.40	1.44	1.47	1.51	1.55	1.59
102	8,151	1.16	1.19	1.21	1.24	1.27	1.30	1.33	1.36	1.39	1.42	1.46	1.50	1.54	1.58	1.63
104	7,841	1.17	1.20	1.22	1.25	1.28	1.31	1.34	1.38	1.41	1.45	1.49	1.53	1.57	1.62	1.67
106	7,547	1.18	1.21	1.23	1.26	1.29	1.33	1.36	1.40	1.43	1.47	1.52	1.56	1.61	1.66	1.71
108	7,270	1.19	1.21	1.24	1.28	1.31	1.34	1.38	1.42	1.46	1.50	1.55	1.60	1.65	1.70	1.76
110	7,009	1.19	1.22	1.26	1.29	1.32	1.36	1.40	1.44	1.48	1.53	1.58	1.63	1.69	1.75	1.81
112	6,760	1.20	1.23	1.27	1.30	1.34	1.38	1.42	1.46	1.51	1.56	1.61	1.67	1.73	1.80	1.87
114	6,525	1.21	1.25	1.28	1.32	1.36	1.40	1.44	1.49	1.54	1.59	1.65	1.71	1.78	1.85	1.93
116	6,302	1.22	1.26	1.29	1.33	1.37	1.42	1.46	1.52	1.57	1.63	1.69	1.76	1.83	1.91	1.99
118	6,090	1.23	1.27	1.31	1.35	1.39	1.44	1.49	1.54	1.60	1.66	1.73	1.80	1.88	1.97	2.07
120	5,889	1.24	1.28	1.32	1.36	1.41	1.46	1.51	1.57	1.63	1.70	1.78	1.85	1.94	2.04	2.14
122	5,698	1.25	1.29	1.33	1.38	1.43	1.48	1.54	1.60	1.67	1.74	1.82	1.91	2.00	2.11	2.23
124	5,515	1.26	1.30	1.35	1.40	1.45	1.51	1.57	1.64	1.71	1.79	1.87	1.97	2.07	2.19	2.32
126	5,342	1.27	1.32	1.37	1.42	1.47	1.53	1.60	1.67	1.75	1.83	1.93	2.03	2.15	2.28	2.43
128	5,176	1.28	1.33	1.38	1.44	1.50	1.56	1.63	1.71	1.79	1.88	1.99	2.10	2.23	2.38	2.55
130	5,018	1.29	1.34	1.40	1.46	1.52	1.59	1.66	1.75	1.84	1.94	2.05	2.18	2.32	2.49	2.68

	Pc = Pc1/[1 + Bd] F'c = 3,000 psi & Ec = 3,321 ksi															
												MOMENT MAGNIFIER 'S' 5'-6" COLUMN (CON'T.) Pul = (Pu x (1 + Bd))				
Klu (ft)	Pc1 (Kips)	Pul 800 S	Pul 900 S	Pul 1000 S	Pul 1100 S	Pul 1200 S	Pul 1300 S	Pul 1400 S	Pul 1500 S	Pul 1600 S	Pul 1700 S	Pul 1800 S	Pul 1900 S	Pul 2000 S	Pul 2100 S	Pul 2200 S
132	4,867	1.31	1.36	1.42	1.48	1.54	1.62	1.70	1.79	1.89	2.00	2.12	2.26	2.42	2.61	
134	4,723	1.32	1.37	1.43	1.50	1.57	1.65	1.73	1.83	1.94	2.06	2.20	2.35	2.53		
136	4,585	1.33	1.39	1.45	1.52	1.60	1.68	1.77	1.88	1.99	2.13	2.28	2.45	2.65		

Maximum kl_u value=137.5 that may be used on 5'-6" column.

Pc = Pc1/[1 + Bd] MOMENT MAGNIFIER 'S' 6'-0" COLUMN

F'c = 4,000 psi & Ec = 3,834 ksi Pu1 = (Pu x (1 + Bd))

Klu (ft)	Pc_1 (Kips)	Pu1 1200 S	Pu1 1300 S	Pu1 1400 S	Pu1 1500 S	Pu1 1600 S	Pu1 1700 S	Pu1 1800 S	Pu1 1900 S	Pu1 2000 S	Pu1 2100 S	Pu1 2200 S	Pu1 2300 S	Pu1 2400 S	Pu1 2500 S	Pu1 2600 S
90	17,118	1.11	1.12	1.13	1.14	1.15	1.17	1.18	1.19	1.20	1.21	1.22	1.24	1.25	1.26	1.28
92	16,382	1.12	1.13	1.14	1.15	1.16	1.17	1.19	1.20	1.21	1.22	1.24	1.25	1.26	1.28	1.29
94	15,693	1.12	1.13	1.15	1.16	1.17	1.18	1.20	1.21	1.22	1.24	1.25	1.26	1.28	1.29	1.31
96	15,046	1.13	1.14	1.15	1.17	1.18	1.19	1.21	1.22	1.23	1.25	1.26	1.28	1.30	1.31	1.33
98	14,438	1.13	1.15	1.16	1.17	1.19	1.20	1.22	1.23	1.25	1.26	1.28	1.29	1.31	1.33	1.35
100	13,866	1.14	1.15	1.17	1.18	1.20	1.21	1.23	1.24	1.26	1.28	1.29	1.31	1.33	1.35	1.37
102	13,328	1.15	1.16	1.18	1.19	1.21	1.22	1.24	1.26	1.27	1.29	1.31	1.33	1.35	1.37	1.39
104	12,820	1.15	1.17	1.18	1.20	1.22	1.23	1.25	1.27	1.29	1.31	1.32	1.34	1.37	1.39	1.41
106	12,341	1.16	1.18	1.19	1.21	1.23	1.25	1.26	1.28	1.30	1.32	1.34	1.36	1.38	1.41	1.43
108	11,888	1.17	1.19	1.20	1.22	1.24	1.26	1.28	1.30	1.32	1.34	1.36	1.38	1.41	1.43	1.45
110	11,459	1.18	1.19	1.21	1.23	1.25	1.27	1.29	1.31	1.33	1.35	1.38	1.40	1.43	1.45	1.48
112	11,054	1.18	1.20	1.22	1.24	1.26	1.28	1.30	1.33	1.35	1.37	1.40	1.42	1.45	1.48	1.51
114	10,669	1.19	1.21	1.23	1.25	1.27	1.29	1.32	1.34	1.37	1.39	1.42	1.44	1.48	1.50	1.53
116	10,305	1.20	1.22	1.24	1.26	1.29	1.31	1.33	1.36	1.38	1.41	1.44	1.47	1.50	1.53	1.56
118	9,958	1.21	1.23	1.25	1.27	1.30	1.32	1.35	1.37	1.40	1.43	1.46	1.49	1.53	1.56	1.59
120	9,629	1.22	1.24	1.26	1.29	1.31	1.34	1.36	1.39	1.42	1.45	1.48	1.52	1.55	1.59	1.63
122	9,316	1.23	1.25	1.27	1.30	1.33	1.35	1.38	1.41	1.44	1.47	1.51	1.54	1.58	1.62	1.66
124	9,018	1.23	1.26	1.28	1.31	1.34	1.37	1.40	1.43	1.46	1.50	1.53	1.57	1.61	1.66	1.70
126	8,734	1.24	1.27	1.30	1.33	1.35	1.39	1.42	1.45	1.49	1.52	1.56	1.60	1.65	1.69	1.74
128	8,463	1.25	1.28	1.31	1.34	1.37	1.40	1.44	1.47	1.51	1.55	1.59	1.63	1.68	1.73	1.78
130	8,205	1.26	1.29	1.32	1.35	1.39	1.42	1.46	1.49	1.53	1.58	1.62	1.67	1.72	1.77	1.83
132	7,958	1.27	1.30	1.34	1.37	1.40	1.44	1.48	1.52	1.56	1.61	1.65	1.70	1.76	1.81	1.88
134	7,722	1.29	1.32	1.35	1.38	1.42	1.46	1.50	1.54	1.59	1.64	1.69	1.74	1.80	1.86	1.93
136	7,497	1.30	1.33	1.36	1.40	1.44	1.48	1.52	1.57	1.62	1.67	1.72	1.78	1.84	1.91	1.98
138	7,281	1.31	1.34	1.38	1.42	1.46	1.50	1.55	1.59	1.65	1.70	1.76	1.82	1.89	1.96	2.04
140	7,074	1.32	1.36	1.39	1.43	1.48	1.52	1.57	1.62	1.68	1.74	1.80	1.87	1.94	2.02	2.11
142	6,877	1.33	1.37	1.41	1.45	1.50	1.56	1.60	1.65	1.71	1.77	1.84	1.92	1.99	2.08	2.17
144	6,687	1.34	1.38	1.43	1.47	1.52	1.57	1.62	1.68	1.75	1.81	1.89	1.97	2.05	2.15	2.25
146	6,505	1.36	1.40	1.44	1.49	1.54	1.60	1.65	1.72	1.78	1.86	1.93	2.02	2.11	2.21	2.33
148	6,330	1.37	1.42	1.46	1.51	1.57	1.62	1.68	1.75	1.82	1.90	1.99	2.08	2.18	2.29	2.42
150	6,163	1.39	1.43	1.48	1.53	1.59	1.65	1.72	1.79	1.86	1.95	2.04	2.14	2.25	2.38	2.52

Maximum klu value=150 that may be used on 6'-0" column.

Pc = Pc1/[1 + Bd] MOMENT MAGNIFIER 'S' 6'-6" COLUMN
F'c = 4,000 psi & Ec = 3,834 ksi Pu1 = (Pu x (1 + Bd))

Klu (ft)	Pc1 (Kips)	Pu1 1600 S	Pu1 1700 S	Pu1 1800 S	Pu1 1900 S	Pu1 2000 S	Pu1 2100 S	Pu1 2200 S	Pu1 2300 S	Pu1 2400 S	Pu1 2500 S	Pu1 2600 S	Pu1 2700 S	Pu1 2800 S	Pu1 2900 S	Pu1 3000 S
100	19,098	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.28	1.29
102	18,357	1.14	1.15	1.16	1.17	1.18	1.20	1.21	1.22	1.23	1.24	1.25	1.27	1.28	1.29	1.30
104	17,658	1.15	1.16	1.17	1.18	1.19	1.20	1.22	1.23	1.24	1.25	1.27	1.28	1.29	1.31	1.32
106	16,998	1.16	1.17	1.18	1.19	1.20	1.21	1.23	1.24	1.25	1.27	1.28	1.29	1.31	1.32	1.34
108	16,374	1.16	1.17	1.19	1.20	1.21	1.22	1.24	1.25	1.26	1.28	1.29	1.31	1.32	1.34	1.35
110	15,784	1.17	1.18	1.19	1.21	1.22	1.23	1.25	1.26	1.28	1.29	1.31	1.32	1.34	1.36	1.37
112	15,225	1.18	1.19	1.20	1.22	1.23	1.25	1.26	1.28	1.29	1.31	1.32	1.34	1.36	1.37	1.39
114	14,696	1.18	1.20	1.21	1.23	1.24	1.26	1.27	1.29	1.30	1.32	1.34	1.36	1.37	1.39	1.41
116	14,193	1.19	1.21	1.22	1.24	1.25	1.27	1.28	1.30	1.32	1.34	1.35	1.37	1.39	1.41	1.43
118	13,716	1.20	1.22	1.23	1.25	1.26	1.28	1.30	1.32	1.33	1.35	1.37	1.39	1.41	1.43	1.45
120	13,263	1.21	1.22	1.24	1.26	1.27	1.29	1.31	1.33	1.35	1.37	1.39	1.41	1.43	1.45	1.48
122	12,832	1.22	1.23	1.25	1.27	1.29	1.31	1.32	1.34	1.36	1.39	1.41	1.43	1.45	1.48	1.50
124	12,421	1.23	1.24	1.26	1.28	1.30	1.32	1.34	1.36	1.38	1.40	1.43	1.45	1.48	1.50	1.53
126	12,030	1.23	1.25	1.27	1.29	1.31	1.33	1.35	1.38	1.40	1.42	1.45	1.47	1.50	1.53	1.55
128	11,657	1.24	1.26	1.28	1.30	1.32	1.35	1.37	1.39	1.42	1.44	1.47	1.49	1.52	1.55	1.58
130	11,301	1.25	1.27	1.29	1.32	1.34	1.36	1.39	1.41	1.44	1.46	1.49	1.52	1.55	1.58	1.61
132	10,961	1.26	1.28	1.31	1.33	1.35	1.38	1.40	1.43	1.46	1.48	1.51	1.54	1.57	1.61	1.64
134	10,636	1.27	1.30	1.32	1.34	1.37	1.39	1.42	1.45	1.48	1.51	1.54	1.57	1.60	1.64	1.67
136	10,326	1.28	1.31	1.33	1.36	1.38	1.41	1.44	1.47	1.50	1.53	1.56	1.60	1.63	1.67	1.71
138	10,029	1.30	1.32	1.34	1.37	1.40	1.43	1.46	1.49	1.52	1.55	1.59	1.62	1.66	1.70	1.75
140	9,744	1.31	1.33	1.36	1.39	1.41	1.44	1.48	1.51	1.54	1.58	1.62	1.66	1.70	1.74	1.79
142	9,472	1.32	1.34	1.37	1.40	1.43	1.46	1.50	1.53	1.57	1.61	1.65	1.69	1.73	1.78	1.83
144	9,210	1.33	1.36	1.39	1.42	1.45	1.48	1.52	1.55	1.59	1.63	1.68	1.72	1.77	1.82	1.87
146	8,960	1.34	1.37	1.40	1.43	1.47	1.50	1.54	1.58	1.62	1.66	1.71	1.76	1.81	1.86	1.92
148	8,719	1.36	1.39	1.42	1.45	1.49	1.52	1.56	1.60	1.65	1.69	1.74	1.79	1.85	1.91	1.97
150	8,488	1.37	1.40	1.43	1.47	1.51	1.55	1.59	1.63	1.68	1.73	1.78	1.83	1.89	1.95	2.02
152	8,266	1.38	1.42	1.45	1.49	1.53	1.57	1.61	1.66	1.71	1.76	1.82	1.87	1.94	2.00	2.08
154	8,053	1.40	1.43	1.47	1.51	1.55	1.59	1.64	1.69	1.74	1.80	1.86	1.92	1.99	2.06	2.14
156	7,848	1.41	1.45	1.49	1.53	1.57	1.62	1.67	1.72	1.78	1.84	1.90	1.97	2.04	2.12	2.20
158	7,650	1.43	1.47	1.51	1.55	1.60	1.65	1.70	1.75	1.81	1.88	1.94	2.02	2.10	2.18	2.27
160	7,460	1.44	1.48	1.53	1.57	1.62	1.67	1.73	1.79	1.85	1.92	1.99	2.07	2.16	2.25	2.35

	Pc = Pc1/[1 + Bd] F'c = 4,000 psi & Ec = 3,834 ksi	MOMENT MAGNIFIER 'δ' 6'-6" COLUMN (CON'T.) Pu1 = (Pu x (1 + Bd))														
Klu (ft)	Pc_1 (Kips)	Pu1 1600 δ	Pu1 1700 δ	Pu1 1800 δ	Pu1 1900 δ	Pu1 2000 δ	Pu1 2100 δ	Pu1 2200 δ	Pu1 2300 δ	Pu1 2400 δ	Pu1 2500 δ	Pu1 2600 δ	Pu1 2700 δ	Pu1 2800 δ	Pu1 2900 δ	Pu1 3000 δ
162	7,277	1.46	1.50	1.55	1.59	1.65	1.70	1.76	1.82	1.89	1.96	2.04	2.13	2.22	2.32	2.43

Maximum kl_u value=162.5 that may be used on 6'-6" column.