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Sri Lanka Standard

SPECIFICATION FOR WOOD POLES FOR OVERHEAD POWER AND TELECOMMUNICATION LINES

PART 3 : DESIGN DATA AND POLE CLASSES

SRI LANKA STANDARDS INSTITUTION

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SPECIFICATION FOR WOOD POLES FOR OVERHEAD POWER AND TELECOMMUNICATION LINES

Part 3 Design data and pole classes

FOREWORD

This Sri Lanka Standard was authorized for adoption and publication by the Council of the Sri Lanka Standards Institution on 89-05-12, after the draft, finalized by the drafting committee on Wood Poles for Overhead Power and Telecommunication Lines, had been approved by the Electrical Engineering Divisional Committee.

The need for a standard for wood poles was felt to be necessary with a view to

a) achieving uniformity and quality of production ;
b) ensuring that poles are used according to their load capabilities ; and
c) encouraging the production of a larger quantum of poles by the proper classification of all usable locally grown species.

This standard comes in four parts. This part (Part 3) deals with design data and pole classes. Part 1 covers Terminology of wood poles; Part 2 covers selection and preparation of wood poles for treatment; and Part 4 specifies test to determine mechanical and physical properties of poles.

All values in this specification are given in SI units.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of test or observation shall be rounded off in accordance with CS 102. The number of figures to be retained in the rounded off values shall be the same as that of the specified value in this standard.

The assistance derived from the publications of the American National Standards Institution and British Standards Institution, in the preparation of this standard is gratefully acknowledged.

1 SCOPE

This part of the standard covers basis of design and design data for both unstayed and stayed poles. It also specifies dimensions of pole classes for species listed in Part 2 of this standard.

2 REFERENCES

CS 1Ø2 Presentation of numerical values

SLS ...* Part 1 Specification for wood poles for overhead power and telecommunication lines.

3 DEFINITIONS

The definitions given in SLS ... Part 1, shall apply for the purpose of this standard.

4 DESIGN DATA FOR THE STRENGTH OF POLES, UNSTAYED AND STAYED

4.1 Loads

Ultimate loads for different classes of poles are given in Table 1.

TABLE 1 - Class of poles with corresponding ultimate loads

Class of pole	Ultimate load (kN) applied at Ø.6 m from the top	Class of pole	Ultimate load (kN) applied at Ø.6 m from the top
1Ø	2.Ø	2	11.6
9	2.5	1	13.6
8	3.2	H_1	15.7
7	4.1	H_2	17.9
6	5.2	H_3	2Ø.2
5	6.5	H_4	22.6
4	8.Ø	H_5	25.1
3	9.7	H_6	27.7

4.2 Unstayed poles

Table 3 to Table 7 are derived assuming that the load is applied Ø.6 m from the top of the pole and are based on the material property values given in Table 2.

*under preparation

TABLE 2 - Mean modulus of elasticity, and mean ultimate bending strength for different species

Species	Mean ultimate bending strength (N/mm²)	Mean modulus of elasticity (N/mm²)
Eucalyptas Microcorys	122.66	16425
Eucalyptas grandis	47.34	5400
Alstonia	81.78	7860
Naa	102.90	11200
Hora	86.08	11250

The ultimate loads F were calculated according to simple bending theory and, assuming a rigidly supported cantilever. Table of each species gives the diameters at the ground line corresponding to the load classification and length of pole.
The calculations have taken account of the fact that critical section occurs :
a) at the ground line ; or
b) at the point where the diameter is equal to 1.5 times the diameter at the point of application of load, if this point is above the ground line.

In the derivation of Table 3 to Table 7 it was found that the ultimate load condition was the governing criterion as:
i) load-deformation curves of tested poles indicated that poles are stressed elastically at the service load;
ii) deformation of the pole has no significant effect on its usage; and
iii) a considerable portion of the deformation on any unstayed pole is due to wind load which is of a transient nature.

$$\text{Service load} = \frac{\text{Ultimate load}}{\text{PSFL X PSFM}}$$

where,
PSFL is the Partial Safety Factor for Load (=1.6); and
PSFM is Partial Safety Factor for Materials (=2.15).

The ultimate load F (N) is given by the expression :

$$F = fz/l_o$$

where

f is the ultimate bending strength (N/mm²) ;
l_o is the distance between the critical section and the point of application of the load (mm) ; and
z is the section modulus (mm³) at the critical section of diameter, d_o, and is given by

$$\frac{(d_o)^3}{32}$$

The deflection δ, at the point of application of the load is given by the expression,

$$\delta = \frac{64h^3 p}{3 E d_1^3 d_2}$$

where

E is the modulus of elasticity (N/mm²) ;

d_1 is the diameter at the ground line (mm) ;

d_2 is the diameter at the point of application of the load (mm) ;
h is the distance from the ground line to the point of application of the load (mm) ; and
p is the ultimate load (N) of the pole divided by 3.44(= 1.6 X 2.15).

NOTE
If the load is to be applied at a position other than 0.6 m below the top of the pole, Table 3 to Table 7 are no longer applicable, and the diameter should be calculated for the particular loading condition using the above formulae.

4.3 Stayed poles (struts or columns)
Where stays are used,the ability of the pole to resist the crippling loads due to the vertical component of the forces in the stays should be considered. The ultimate crippling loads given in Table8 to Table 12 are for guidance only. They are calculated from the Euler formula for columns, modified to allow for :

a) the tapered section of round poles ;
b) the imperfect rigidity of the ground in which the poles are planted ; and

c) a degree of stability at the top of the pole due to stays and line wires.

The crippling loads F_c (N) are given by the expression :

$$F_c = 3.92175 \times 10^{-7} \times \frac{E \times (d_m)^4}{l^2}$$

where

E is the Modulus of Elasticity of the timber species (N/mm^2);

l is the effective length,which is taken as the length between a point 0.3 m below the top and 0.3 m below ground line and is therefore equal to L - D (m);

d_m is the effective diameter (mm), given by the expression ;

$$d_m = d_t + \frac{(L - D + 0.9)(d_g - d_t)}{3(L - D)}$$

where

L is the full length (m) ;

D is the depth of planting (m) ;

d_t is the diameter at the top end of the pole (mm) ; and

d_g is the diameter at ground line(mm).

The values calculated using these formulae and included in Table 8 to Table 12 should be used with caution, especially when the pole is to be set in particularly unstable ground.

NOTE

It is good practice to select the straightest and stoutest poles for stayed poles.

5 POLE CLASSES

Poles meeting the requirements of this standard are grouped into classes identified in Table 3 to Table 7, based on their diameter measured at the ground line. The distance of the ground line from the butt is specified in Table 3 to Table 12 depending on nominal length of the pole. Poles of a given class and length are designed to have approximately the same load carrying capacity regardless of species.

Table 3 Pole dimensions for Eucalyptus microcorys

Class:		H6	H5	H4	H3	H2	H3	1	2	3	3	5	6	7	8	9	10
Length (m)	GL dist. from butt (m)	Min. diameter at G.L.															
6.00	1.20	-	-	-	195	185	180	170	160	155	145	135	125	120	120	120	120
6.50	1.20	-	-	-	200	195	185	175	170	160	150	140	130	120	120	120	120
7.00	1.20	-	-	-	210	200	190	185	175	165	155	145	135	125	120	120	120
7.50	1.50	235	225	220	210	205	195	185	175	165	155	145	135	125	120	120	120
8.00	1.50	240	235	225	215	210	200	190	180	170	160	150	140	130	120	120	120
8.50	1.50	250	240	230	225	215	205	195	185	175	165	155	145	130	120	-	-
9.00	1.50	255	245	235	230	220	210	200	190	180	170	160	145	135	125	120	-
9.50	1.50	260	250	245	235	225	215	205	195	185	175	160	150	140	130	120	-
10.00	1.50	265	255	250	240	230	220	210	200	190	175	165	155	140	130	120	120
10.50	1.50	270	260	255	245	235	225	215	205	190	180	170	155	145	135	125	120
11.00	1.80	275	265	255	245	235	225	215	205	195	180	170	155	145	135	125	120
11.50	1.80	280	270	260	250	240	230	220	210	195	185	175	160	150	135	125	120
12.00	1.80	285	275	265	255	245	235	225	210	200	190	175	165	150	140	130	125
12.50	1.80	290	280	270	260	250	240	230	215	205	190	180	165	155	140	135	-
13.00	1.80	295	285	275	265	255	245	230	220	205	195	180	170	155	145	135	125
13.50	1.80	295	285	280	270	255	245	235	225	210	195	185	170	160	145	135	125
14.00	2.10	300	290	280	270	260	250	235	225	210	200	185	170	160	145	135	125
14.50	2.10	305	295	285	270	260	250	240	225	215	200	190	175	160	150	135	130
15.00	2.10	305	295	285	275	265	255	245	230	215	205	190	175	165	150	140	130
15.50	2.10	310	300	290	280	270	260	245	235	220	205	195	180	165	155	140	130
16.00	2.10	315	305	295	285	275	260	250	235	225	210	195	180	170	155	145	135

Table 4 Pole dimensions for Eucalyptus grandis

Class:		H6	H5	H4	H3	H2	H1	1	2	3	4	5	6	7	8	9	10
Length (m)	GL dist. from butt (m)	Min. diameter at G.L.															
6.00	1.20	–	–	–	–	–	–	–	–	–	195	185	170	155	145	135	125
6.50	1.20	–	–	–	–	–	–	–	–	–	–	190	175	165	150	140	130
7.00	1.20	–	–	–	–	–	–	–	–	225	210	195	180	170	155	145	135
7.50	1.50	–	–	–	–	–	–	–	240	225	215	200	185	170	155	145	135
8.00	1.50	–	–	–	–	–	–	–	250	235	220	205	190	175	160	150	135
8.50	1.50	–	–	–	–	–	–	270	255	240	225	210	195	180	165	155	140
9.00	1.50	–	–	–	315	300	290	275	260	245	230	215	200	185	170	155	150
9.50	1.50	–	–	–	320	310	295	280	265	250	235	220	205	190	175	160	160
10.00	1.50	–	–	340	330	315	300	285	275	255	240	225	210	195	180	165	155
10.50	1.50	–	–	–	–	320	310	295	280	260	245	230	215	195	180	170	155
11.00	1.80	–	–	–	–	–	310	295	280	265	250	230	215	200	185	170	155

Table 5 Pole dimensions for Alstonia

CLASS		H6	H5	H4	H3	H2	H1	1	2	3	4	5	6	7	8	9	10
Length (m)	GL dist. from butt (m)	Min. diameter at G.L.															
6.00	1.20	–	–	–	–	–	–	195	185	175	165	155	140	130	120	120	120
6.50	1.20	–	–	–	–	–	–	200	190	180	170	160	145	135	125	120	120
7.00	1.20	–	–	–	–	–	220	210	200	185	175	165	150	140	130	120	120
7.50	1.50	–	–	–	240	230	220	210	200	190	180	165	155	145	130	120	120
8.00	1.50	–	–	–	250	240	230	220	205	195	185	170	160	145	135	125	120
8.50	1.50	285	275	265	255	245	235	225	210	200	190	175	165	150	140	130	120
9.00	1.50	290	280	270	260	250	240	230	220	205	195	180	165	155	145	130	120
9.50	1.50	295	285	280	270	255	245	235	225	210	195	185	170	160	145	135	120
10.00	1.50	305	295	285	275	265	250	240	230	215	200	190	175	160	150	140	125
10.50	1.50	310	300	290	280	270	255	245	230	220	205	190	180	165	150	140	130
11.00	1.80	310	300	290	280	270	260	245	235	220	205	195	180	165	155	140	130
11.50	1.80	–	–	295	285	275	265	250	240	225	210	195	185	170	155	145	135
12.00	1.80	–	–	305	290	280	270	255	245	230	215	200	185	170	160	145	135
12.50	1.80	330	320	310	295	285	275	260	245	235	220	205	190	175	160	145	140
13.00	1.80	–	325	315	300	290	280	265	250	235	220	205	195	180	165	150	140
13.50	1.80	–	–	–	–	325	310	295	280	265	250	235	215	200	185	170	160
14.00	2.10	–	–	320	310	295	280	270	255	240	225	210	195	180	165	155	145
14.50	2.10	–	–	325	310	300	285	275	260	245	230	215	200	185	170	155	145
15.00	2.10	–	–	325	330	315	290	280	265	250	235	220	200	185	170	160	150
15.50	2.10	355	345	335	320	310	295	280	265	250	235	220	205	190	175	160	150
16.00	2.10	360	350	335	325	310	300	285	270	255	240	225	210	190	175	165	150

Table 6 Pole dimensions for Naa

class:			H6	H5	H4	H3	H2	H1	1	2	3	4	5	6	7	8	9	10
Length (mm)	G (mm)	L-G (mm)	27.7	25.1	22.6	20.2	17.9	15.7	13.6	11.6	9.7	8	6.5	5.2	4.1	3.2	2.5	2
			Ground line diameter (mm)															
6.00	1800	4200	256	247	239	230	221	212	202	191	180	169	158	146	135	124	115	106
6.50	1800	4700	265	257	248	239	229	220	209	199	187	175	164	152	140	129	119	110
7.00	1800	5200	274	266	256	247	237	227	217	205	193	181	169	157	145	134	123	114
7.50	1800	5700	283	274	264	255	245	234	223	212	199	187	175	162	150	138	127	118
8.00	1500	6500	296	286	276	266	256	245	233	221	208	195	182	169	156	144	133	123
8.50	1500	7000	303	293	283	273	262	251	239	227	214	200	187	174	160	148	136	126
9.00	1500	7500	310	300	290	279	268	257	245	232	219	205	191	178	164	151	139	129
9.50	1500	8000	317	307	296	285	274	262	250	237	223	209	195	181	168	154	142	132
10.00	1500	8500	323	313	302	291	279	268	255	242	228	214	199	185	171	157	145	135
10.50	1500	9000	329	319	308	297	285	273	260	247	232	218	203	189	174	160	148	137
11.00	1800	9200	332	321	310	299	287	275	262	248	234	219	205	190	176	162	149	138
11.50	1800	9700	338	327	316	304	292	280	267	253	238	223	208	193	179	165	152	141
12.00	1800	10200	344	332	321	309	297	284	271	257	242	227	212	197	182	167	154	143
12.50	1800	10700	349	338	326	314	302	289	275	261	246	231	215	200	185	170	157	145
13.00	1800	11200	354	343	331	319	306	293	280	265	250	234	219	203	187	173	159	148
13.50	1800	11700	360	348	336	324	311	298	284	269	253	238	222	206	190	175	161	150
14.00	2100	11900	362	350	338	326	313	299	285	271	255	239	223	207	191	176	162	151
14.50	2100	12400	367	355	343	330	317	303	289	274	258	242	226	210	194	179	164	153
15.00	2100	12900	372	360	347	334	321	307	293	278	262	246	229	213	197	181	167	155
15.50	2100	13400	376	364	352	339	325	311	297	281	265	249	232	215	199	183	169	157
16.00	2100	13900	381	369	356	343	329	315	300	285	268	252	235	218	201	185	171	159

Table 7 Pole dimensions for Hora

Class		H6	H5	H4	H3	H2	H1	1	2	3	4	5	6	7	8	9	10
Length(m)	GL dist. from butt (m)	Min. diameter at G.L.															
6.00	1.20	-	-	-	-	-	200	190	180	170	160	150	140	130	-	-	-
6.50	1.20	-	-	-	-	-	-	200	190	180	165	155	145	135	125	-	-
7.00	1.20	-	-	-	-	225	215	205	195	185	175	160	150	140	130	120	-
7.50	1.50	-	-	-	235	230	220	210	200	185	175	165	150	140	130	120	-
8.00	1.50	-	-	-	245	235	225	215	205	190	180	170	155	145	135	125	-
8.50	1.50	280	270	260	250	240	230	220	210	195	185	175	160	150	135	125	-
9.00	1.50	285	275	265	255	245	235	225	215	200	190	175	165	150	140	130	-
9.50	1.50	290	285	275	265	255	240	230	220	205	195	180	170	155	145	130	125
10.00	1.50	300	290	280	270	260	245	235	225	210	200	185	170	160	145	135	
10.50	1.50	305	295	285	275	265	250	240	230	215	200	190	175	160	150	140	130
11.00	1.80	305	295	285	275	265	255	245	230	215	205	190	175	165	150	140	130
11.50	1.80	-	-	290	280	270	260	245	235	220	210	195	180	165	155	140	-
12.00	1.80	-	-	300	285	275	265	250	240	225	210	195	185	170	155	145	-
12.50	1.80	325	315	305	290	280	270	255	245	230	215	200	185	170	160	145	135
13.00	1.80	330	320	305	295	285	275	260	245	235	220	205	190	175	160	150	140
13.50	1.80	335	325	310	300	290	275	265	250	235	220	205	190	180	165	150	140
14.00	2.10	335	325	315	305	290	280	265	250	240	225	210	195	180	165	150	140
14.50	2.10	340	330	320	305	295	280	270	255	240	225	210	195	180	165	155	145
15.00	2.10	345	335	325	310	300	285	275	260	245	230	215	200	185	170	155	145
15.50	2.10	350	340	325	315	305	290	275	265	245	230	215	200	185	170	160	145
16.00	2.10	355	345	330	320	305	295	280	265	250	235	220	205	190	175	160	150

TABLE 8 - Crippling load for Eucalyptus microcorys

Class		H6	H5	H4	H3	H2	H1	1	2	3	4	5	6	7	8	9	10
Length (m)	GL dist. from butt d-- (m)	crippling load (kN)															
6.00	1.20	-	-	-	158	128	114	90	72	62	48	36	26	21	21	21	21
6.50	1.20	-	-	-	142	128	103	83	73	57	45	34	25	18	18	18	18
7.00	1.20	-	-	-	144	119	97	86	68	54	42	32	25	18	18	18	18
7.50	1.50	217	183	167	137	125	103	83	67	53	40	31	23	17	14	14	14
8.00	1.50	200	183	155	128	117	97	78	62	50	39	29	23	17	12	12	12
8.50	1.50	202	172	144	133	111	90	75	61	48	37	29	23	14	10	0	0
9.00	1.50	189	161	136	125	104	87	72	57	47	37	29	20	15	10	9	0
9.50	1.50	178	153	141	119	100	84	68	56	45	36	25	20	15	10	7	0
10.00	1.50	170	145	134	114	97	81	67	54	45	32	25	20	12	9	7	7
10.50	1.50	162	141	130	111	94	78	65	54	40	32	25	17	14	10	7	6
11.00	1.80	172	148	126	108	90	76	64	53	43	31	25	17	12	9	7	6
11.50	1.80	166	144	123	104	89	75	62	53	39	31	25	17	14	9	6	6
12.00	1.80	159	139	120	103	87	73	62	47	39	31	23	18	12	9	6	6
12.50	1.80	155	134	117	100	86	73	61	47	39	28	23	15	12	7	7	0
13.00	1.80	151	131	114	98	84	72	56	47	36	29	20	17	10	9	6	4
13.50	1.80	139	120	112	97	76	65	56	47	36	26	21	15	12	7	6	4
14.00	2.10	145	126	111	95	83	70	54	47	34	28	20	15	12	7	6	4
14.50	2.10	142	125	109	87	75	64	54	42	36	26	21	15	10	7	6	4
15.00	2.10	131	115	100	87	75	64	54	42	32	26	20	14	10	7	6	4
15.50	2.10	130	114	100	86	75	64	50	42	32	25	20	14	10	7	4	4
16.00	2.10	128	112	98	86	75	59	51	39	32	25	18	14	10	7	6	4

TABLE 9 - Crippling loads for Eucalyptus grandis

Class		H4	H3	H2	H1	1	2	3	4	5	6	7	8	9	10
Length (m)	GL dist. from butt d (m)	crippling load (kN)													
6.00	1.20	-	-	-	-	-	-	-	52	42	29	20	15	11	8
6.50	1.20	-	-	-	-	-	-	-	0	38	27	21	14	11	8
7.00	1.20	-	-	-	-	-	-	62	47	35	25	20	13	10	8
7.50	1.50	-	-	-	-	-	77	60	49	37	27	19	13	10	7
8.00	1.50	-	-	-	-	-	77	60	46	35	25	18	12	9	6
8.50	1.50	-	-	-	-	90	72	56	43	32	24	18	12	9	6
9.00	1.50	-	145	119	104	84	67	53	41	31	23	17	12	8	7
9.50	1.50	-	135	118	97	79	63	50	39	30	22	16	11	8	8
10.00	1.50	151	134	112	92	75	64	47	37	29	22	16	11	8	6
10.50	1.50	-	-	106	93	76	62	46	36	28	21	14	10	8	5
11.00	1.80	-	-	-	87	72	58	46	37	26	20	14	11	7	5
11.50	1.80	-	-	-	-	-	56	45	36	25	20	14	9	7	5
12.00	1.80	-	-	-	-	66	54	43	32	25	19	13	9	7	5

TABLE 10 - Crippling load for Alstonia

Class		H6	H5	H4	H3	H2	H1	1	2	3	4	5	6	7	8	9	10
Length (m)	GL dist. from butt d (m)	crippling load (kN)															
6.00	1.20	-	-	-	-	-	-	75	61	48	38	29	20	14	10	10	10
6.50	1.20	-	-	-	-	-	-	68	55	44	35	27	18	14	10	8	8
7.00	1.20	-	-	-	-	-	83	68	56	41	32	26	17	13	9	7	7
7.50	1.50	-	-	-	113	95	80	65	54	44	35	25	19	14	9	6	6
8.00	1.50	-	-	-	112	95	80	67	50	41	33	23	18	12	9	6	5
8.50	1.50	163	141	122	104	89	75	63	47	39	32	23	17	12	9	6	5
9.00	1.50	151	131	113	98	83	71	59	50	38	30	22	15	12	9	5	4
9.50	1.50	142	123	115	99	79	67	56	47	36	26	21	15	11	8	5	3
10.00	1.50	143	125	109	94	81	64	54	46	35	26	21	15	10	8	5	3
10.50	1.50	135	119	104	90	77	62	53	41	34	26	19	15	11	7	5	4
11.00	1.80	132	116	101	88	76	65	51	43	33	25	20	14	10	8	5	3
11.50	1.80	-	-	98	85	74	63	50	42	32	25	18	14	10	7	5	4
12.00	1.80	-	-	100	82	71	62	49	41	32	24	18	13	9	7	5	3
12.50	1.80	125	110	97	79	69	59	47	38	32	24	17	13	9	6	4	3
13.00	1.80	-	107	94	77	68	59	47	37	29	22	17	14	9	6	4	3
13.50	1.80	-	-	-	-	97	80	66	53	43	32	26	18	14	10	7	5
14.00	2.10	-	-	90	79	65	53	45	36	28	22	16	12	8	6	5	3
14.50	2.10	-	-	88	73	64	52	29	35	28	22	17	12	8	6	4	3
15.00	2.10	-	-	81	86	71	51	44	35	28	22	17	11	8	5	4	3
15.50	2.10	107	95	84	70	62	50	41	32	26	20	15	11	8	5	4	3
16.00	2.10	104	93	78	69	57	50	41	32	26	20	15	11	8	5	4	2

Table 11 - Crippling loads for Naa

Class		H6	H5	H4	H3	H2	H1	1	2	3	4	5	6	7	8	9	10
Length (m)	CL dist from butt d (m)	crippling load (kN)															
6.0	1.2	345	337	330	322	314	305	296	288	279	271	261	253	245	237	230	225
6.5	1.2	324	317	309	302	295	287	279	272	263	255	247	239	231	224	217	212
7.0	1.2	306	300	292	286	278	272	264	257	249	242	233	227	220	213	207	201
7.5	1.5	311	305	298	291	285	278	271	263	256	248	241	233	227	221	214	210
8.0	1.5	314	307	301	294	287	280	273	267	258	251	244	237	229	223	216	212
8.5	1.5	296	291	285	278	272	266	259	253	245	238	231	224	217	211	206	201
9.0	1.5	282	276	271	264	259	253	246	241	233	226	220	213	207	201	196	192
9.5	1.5	269	263	258	253	247	241	236	229	223	216	210	204	198	193	188	183
10.0	1.5	257	253	247	242	237	231	225	220	213	207	201	195	190	184	180	176
10.5	1.5	247	242	237	232	227	222	216	211	205	199	193	188	182	177	173	169
11.0	1.8	239	233	229	224	220	214	209	205	198	193	188	182	178	173	168	165
11.5	1.8	229	225	221	216	211	207	201	197	192	186	181	176	171	166	162	159
12.0	1.8	222	217	213	209	205	199	195	190	185	180	175	170	165	161	157	153
12.5	1.8	214	210	206	201	197	193	189	184	179	174	169	164	160	155	152	149
13.0	1.8	208	204	199	196	192	188	182	178	174	168	164	160	155	151	147	144
13.5	1.8	201	197	194	190	185	181	177	173	168	164	159	154	150	147	143	139
14.0	2.1	196	193	189	185	181	177	174	169	164	160	155	151	148	144	141	137
14.5	2.1	191	188	183	180	176	173	168	164	160	155	151	148	144	139	136	134
15.0	2.1	173	169	168	162	159	155	152	148	145	141	136	133	130	126	123	120
15.5	2.1	181	178	175	170	167	164	160	155	152	148	144	139	136	133	130	127
16.0	2.1	177	174	170	166	163	160	155	152	148	144	141	136	133	130	127	123

TABLE 12 - Cripling loads for Hora

Class		H5	H4	H3	H2	H1	1	2	3	4	5	6	7	8	9	10
Length (m)	GL dist. from butt d (m)	crippling load (kN)														
6.00	1.20	-	-	-	-	119	97	78	62	49	122	89	63	49	32	-
6.50	1.20	-	-	-	-	-	97	79	64	45	35	26	20	15	0	-
7.00	1.20	-	-	-	129	108	89	72	59	47	33	25	19	13	10	-
7.50	1.50	-	-	149	136	114	94	78	56	46	36	24	18	13	9	-
8.00	1.50	-	-	149	125	106	87	72	53	42	34	23	18	13	9	-
8.50	1.50	187	162	138	118	98	82	68	51	41	33	23	18	11	8	-
9.00	1.50	388	151	129	110	93	78	65	49	39	28	22	15	11	8	-
9.50	1.50	359	153	133	113	89	75	63	47	38	27	22	15	11	7	6
10.00	1.50	335	145	125	108	85	71	61	46	37	27	19	15	10	7	0
10.50	1.50	316	139	120	104	82	69	59	45	33	27	19	13	10	8	6
11.00	1.80	296	135	118	101	86	74	57	43	36	26	19	15	10	7	5
11.50	1.80	-	130	113	98	84	66	56	42	36	26	19	13	10	7	0
12.00	1.80	-	135	109	95	82	65	55	42	32	23	19	13	9	7	0
12.50	1.80	-	130	106	92	80	63	54	41	32	23	17	12	9	6	5
13.00	1.80	-	119	104	90	78	62	49	41	32	24	18	12	8	6	5
13.50	1.80	-	115	101	89	71	62	49	38	28	22	16	12	9	6	4
14.00	2.10	-	121	107	86	76	61	48	40	32	23	18	12	9	6	4
14.50	2.10	-	119	97	85	69	60	48	37	28	22	16	11	8	6	5
15.00	2.10	-	116	96	84	68	60	47	37	28	22	17	11	8	6	4
15.50	2.10	-	107	95	83	68	54	47	34	26	20	15	11	8	6	4
16.00	2.10	-	106	93	77	67	54	43	35	26	21	16	11	8	5	4