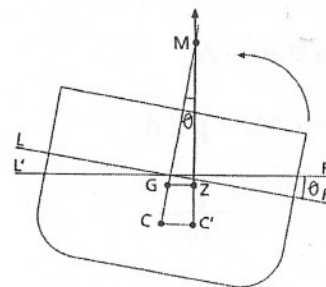


Estabilitat inicial

$KM = KC + CM$ $GM = KM - KG$

$GZ = GM \times \text{Sen } \theta$

$Me = D \times GZ$



Estabilitat per a grans escores

$GZ = KN - KA$

$GZ = KN - (KG \times \text{Sin } \theta)$

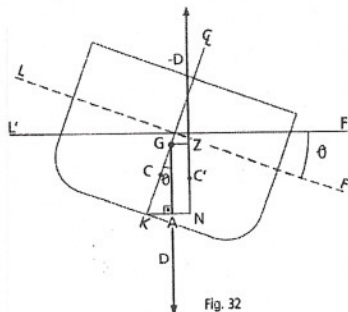
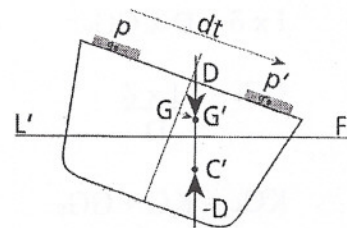
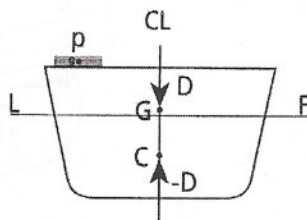


Fig. 32

Trasllat de pesos

$GG' \times D = p \times d$

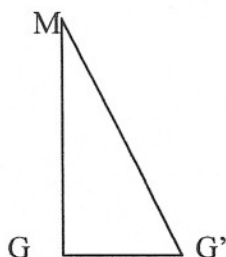
$GG' = \frac{p \times d}{D}$



Càlcul de l'escora

$Tg \theta = \frac{CLG'}{GM}$

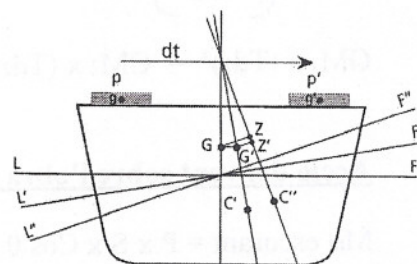
$CLG' = Tg \theta \times GM$



Nou braç d'estabilitat

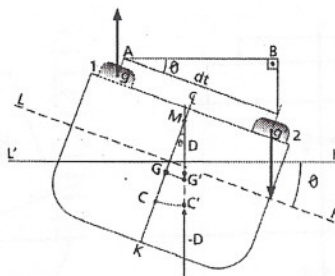
$GZ = KN - (KG \times \text{Sin } \theta)$

$GZ = KN - (KG \times \text{Sin } \theta) - (CLG' \times \text{Cos } \theta)$



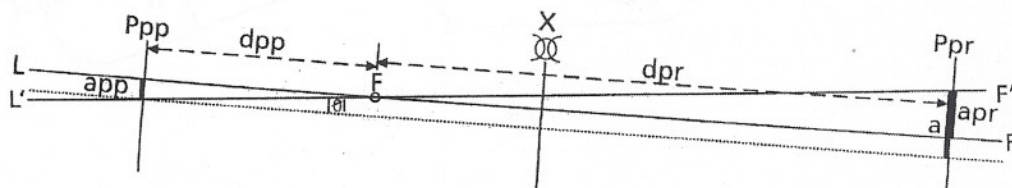
Moment escorant (Mto e)

$M_{nt e} = p \times d \times \text{cos } \theta$



Calats: Assentament (A)

$A = \frac{D (XG - XC)}{M_u}$



Calats: alteració (a)

$$a = A_f - A_i$$

$$a \times M_u = p \times d$$

$$I = E = \frac{p}{T_c}$$

$$d_{pp} = \frac{E \pm XF}{2}$$

$$C_{pp} = C_m \pm a \times \frac{XLA}{E}$$

$$M_u \times a \times 100 = p \times d$$

$$M_{to} = p \times d$$

$$a_{pp} = d_{pp} \times \frac{a}{E}$$

$$a = (C_{pp} - C_m) \times \frac{E}{XLA}$$

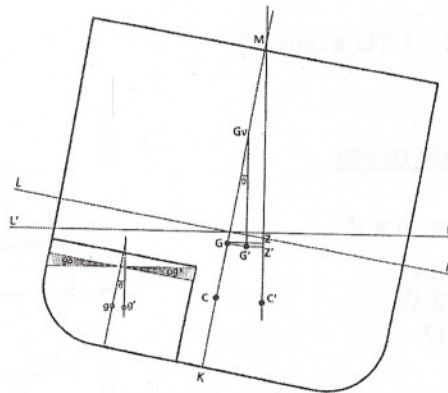
Superfícies lliures

$$I = \frac{1}{12} \times e \times m^3$$

$$I \times \delta = D \times GG_v$$

$$GG_v = \frac{I \times \delta}{D}$$

$$KG_c = KG + GG_v$$



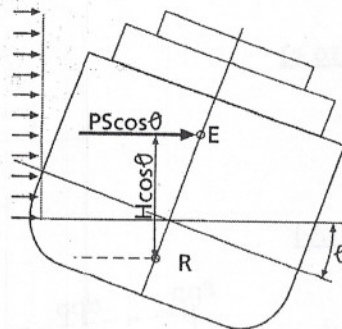
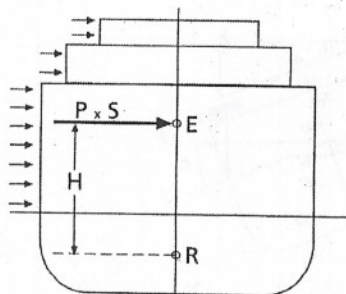
Període de balanç

$$GM_c = \left(\frac{K \times M}{T_d} \right)^2$$

$$GM_1 \times (T_d1)^2 = GM_2 \times (T_d2)^2$$

Acció del vent sobre l'obra morta

$$M_{nt \text{ escorant}} = P \times S \times \cos \theta \times H \times \cos \theta$$



IOT CALAFAT - HIDROSTÀTIQUES

Calat mitjà m.	DES Ton	FLT m ²	XC m	XLA m	KC m	RMT M	RML m	TON l cm T/cm	MOMlcm Txm/cm
2.4	307.8	212.911	19.185	17.353	1.554	2.482	59.805	2.182	5.26
2.41	310	213.197	19.172	17.352	1.56	2.471	59.564	2.185	5.277
2.42	312.2	213.481	19.159	17.351	1.566	2.46	59.324	2.188	5.295
2.43	314.4	213.763	19.145	17.351	1.572	2.449	59.086	2.191	5.312
2.44	316.6	214.039	19.132	17.35	1.578	2.438	58.848	2.194	5.328
2.45	318.8	214.305	19.12	17.351	1.584	2.427	58.606	2.197	5.344
2.46	321	214.569	19.107	17.351	1.59	2.416	58.366	2.199	5.361
2.47	323.2	214.831	19.094	17.352	1.596	2.406	58.129	2.202	5.377
2.48	325.4	215.091	19.082	17.352	1.602	2.395	57.895	2.205	5.399
2.49	327.6	215.351	19.07	17.353	1.608	2.384	57.663	2.207	5.409
2.5	329.8	215.61	19.058	17.354	1.613	2.373	57.434	2.21	5.425
2.51	332.1	215.868	19.046	17.355	1.619	2.363	57.209	2.213	5.441
2.52	334.3	216.125	19.034	17.356	1.625	2.352	56.984	2.215	5.458
2.53	336.5	216.37	19.022	17.358	1.631	2.342	56.757	2.218	5.473
2.54	338.8	216.615	19.011	17.36	1.637	2.331	56.531	2.22	5.489
2.55	341	216.858	18.999	17.361	1.643	2.321	56.309	2.221	5.504
2.56	343.2	217.101	18.988	17.363	1.649	2.311	56.089	2.225	5.52
2.57	345.5	217.345	18.977	17.365	1.655	2.3	55.872	2.228	5.536
2.58	347.7	217.585	18.966	17.367	1.661	2.29	55.654	2.23	5.551
2.59	350	217.825	18.955	17.369	1.667	2.28	55.439	2.233	5.567
2.6	352.2	218.033	18.944	17.369	1.673	2.27	55.187	2.235	5.578
2.61	354.5	218.266	18.934	17.372	1.679	2.26	54.973	2.237	5.593
2.62	356.7	218.495	18.923	17.374	1.685	2.25	54.76	2.24	5.608
2.63	359	218.723	18.913	17.377	1.691	2.24	54.549	2.242	5.623
2.64	361.2	218.952	18.903	17.38	1.969	2.231	54.341	2.244	5.638
2.65	363.5	219.181	18.892	17.383	1.702	2.221	54.136	2.247	5.653
2.66	365.7	219.41	18.882	17.386	1.708	2.211	53.933	2.249	5.669
2.67	368	219.634	18.872	17.389	1.714	2.202	53.729	2.251	5.683
2.68	370.3	219.857	18.863	17.392	1.72	2.192	53.528	2.254	5.698
2.69	372.5	220.081	18.853	17.396	1.726	2.183	53.328	2.256	5.713
2.7	374.8	220.301	18.844	17.399	1.732	2.173	53.129	2.258	5.728
2.71	377.1	220.521	18.834	17.403	1.737	2.164	52.933	2.26	5.743
2.72	379.4	220.741	18.825	17.407	1.743	2.155	52.738	2.263	5.757
2.73	381.7	220.96	18.816	17.41	1.749	2.146	52.546	2.265	5.772
2.74	383.1	219.969	18.847	17.503	1.754	2.132	51.616	2.255	5.695
2.75	385.3	220.326	18.839	17.497	1.759	2.123	51.533	2.258	5.72
2.76	387.6	220.6121	18.832	17.496	1.765	2.114	51.401	2.261	5.74
2.77	389.8	220.882	18.824	17.496	1.771	2.105	51.26	2.264	5.759
2.78	392.1	221.154	18.816	17.496	1.777	2.096	51.122	2.267	5.778
2.79	394.4	221.429	18.809	17.496	1.783	2.088	50.988	2.27	5.797
2.8	396.6	221.711	18.801	17.495	1.788	2.079	50.86	2.273	5.817
2.81	398.9	221.999	18.794	17.494	1.794	2.071	50.737	2.275	5.837
2.82	401.2	222.286	18.786	17.493	1.8	2.063	50.616	2.278	5.858
2.83	403.5	222.557	18.779	17.493	1.806	2.054	50.484	2.281	5.877
2.84	405.8	222.814	18.772	17.495	1.812	2.046	50.345	2.284	5.895
2.85	408	223.068	18.765	17.496	1.817	2.038	50.205	2.286	5.913

2.86	410.3	223.319	18.758	17.498	1.823	2.03	50.065	2.289	5.931
2.87	412.6	223.569	18.751	17.5	1.829	2.022	49.926	2.292	5.948
2.88	141.9	223.817	18.744	17.502	1.835	2.014	49.788	2.294	5.966
2.89	417.2	224.068	18.737	17.504	1.841	2.006	49.652	2.297	5.984
2.9	419.5	224.314	18.73	17.506	1.846	1.999	49.514	2.299	6.002
2.91	421.8	224.561	18.723	17.508	1.852	1.991	49.378	2.302	6.019
2.92	424.1	224.809	18.717	17.51	1.858	1.983	49.245	2.304	6.037
2.93	426.4	225.055	18.71	17.512	1.864	1.976	49.12	2.307	6.055
2.94	428.7	225.302	18.704	17.514	1.869	1.968	48.981	2.309	6.073
2.95	431	225.549	18.697	17.516	1.875	1.961	48.853	2.312	6.091
2.96	433.4	225.798	18.691	17.518	1.881	1.953	48.727	2.314	6.109
2.97	435.7	226.023	18.685	17.518	1.887	1.946	48.576	2.317	6.124
2.98	438	226.27	18.678	17.519	1.892	1.939	48.451	2.319	6.142
2.99	440.3	226.518	18.672	17.521	1.898	1.932	48.328	2.322	6.16
3.00	442.6	226.769	18.666	17.522	1.904	1.925	48.209	2.324	6.179

DES	<i>Desplaçament en tonnes / Desplazamiento en toneladas</i>
XC	<i>Abcisa del Centre de carena des de la perpendicular de popa / Abcisa del Centro de Carena desde la perpendicular de popa</i>
KC	<i>Ordenada del Centre de Carena des de la línia base / Ordenada del Centro de Carena desde la línea base</i>
FLT	<i>Àrea de flotacions / Area de flotaciones</i>
XLA	<i>Abcisa del Centre de Flotació des de la perpendicular de popa / Abcisa del Centro de Flotación desde la perpendicular de popa.</i>
TON 1 cm	<i>Tonnes per centímetre d'immersió / Toneladas por centímetro de inmersión.</i>
MOM 1 cm	<i>Moment unitari en Tonnes metre per canvi d'assentament d'un centímetre / Momento unitario en Toneladas metro por cambio de asiento de un centímetro</i>
RMT	<i>Radi metacèntric transversal / Radio metacéntrico transversal</i>
RML	<i>Radi metacèntric longitudinal / Radio metacéntrico longitudinal</i>

- Densitat de l'aigua (δ) 1.025 T/m³

IOT CALAFAT KN en metres/ metros

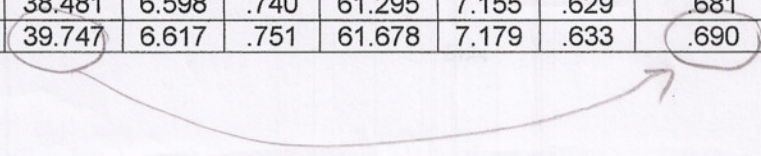
DES T	KN 5°	KN 10°	KN 15°	KN 20°	KN 25°	KN 30°	KN 40°	KN 50°	KN 60°	KN 70°
250	0.364	0.721	1.065	1.387	1.687	1.966	2.454	2.768	2.936	2.982
260	0.362	0.717	1.06	1.384	1.686	1.968	2.453	2.758	2.921	2.967
270	0.359	0.713	1.056	1.382	1.685	1.971	2.45	2.748	2.906	2.951
280	0.357	0.709	1.052	1.379	1.685	1.973	2.446	2.737	2.891	2.935
290	0.355	0.706	1.048	1.375	1.684	1.975	2.441	2.726	2.877	2.919
300	0.353	0.702	1.044	1.372	1.683	1.977	2.435	2.715	2.863	2.903
310	0.351	0.699	1.04	1.369	1.682	1.978	2.427	2.703	2.849	2.887
320	0.349	0.696	1.035	1.366	1.682	1.978	2.419	2.69	2.835	2.873
330	0.347	0.693	1.032	1.363	1.681	1.976	2.409	2.677	2.821	2.859
340	0.346	0.69	1.028	1.36	1.68	1.974	2.399	2.664	2.807	2.845
350	0.344	0.686	1.025	1.358	1.679	1.97	2.388	2.651	2.793	2.832
360	0.343	0.683	1.022	1.355	1.679	1.964	2.377	2.637	2.779	2.82
370	0.341	0.681	1.019	1.353	1.678	1.958	2.365	2.623	2.765	2.807
380	0.339	0.679	1.016	1.351	1.675	1.951	2.352	2.609	2.752	2.795
390	0.338	0.677	1.014	1.349	1.672	1.942	2.338	2.594	2.738	2.784

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Curvas hidrostáticas (Carenas rectas)

PPC Pp F Tc Mu

LA	CM (m)	VOL (m³)	DES Tm	XC (m)	KC (m)	FLT (m)	XLA (m)	Ton 1cm	MOM1cm	RMT (m)	RML (m)
1	.000	.035	0.036	4.320	-.035	.583	4.860	.006	.001	.020	29.160
2	.020	.051	0.052	4.735	-0.21	.778	5.670	.008	.002	.018	50.469
3	.040	.066	0.068	4.955	-.009	.778	5.670	.008	.002	.014	38.594
4	.060	.085	0.087	5.242	.004	.972	6.480	.010	.003	.014	57.985
5	.080	.106	0.109	5.87	.017	1.166	7.290	.012	.005	.013	81.346
6	.100	.130	0.133	5.924	.031	1.166	7.290	.012	.005	.011	66.372
7	.120	.155	0.159	6.182	.043	1.361	8.100	.014	.009	.011	89.906
8	.140	.182	0.187	6.468	.056	1.361	8.100	.014	.009	.009	76.462
9	.160	.210	0.215	6.705	.069	1.361	8.100	.014	.009	.008	66.285
10	.180	.237	0.243	6.865	.080	1.361	8.100	.014	.009	.007	58.679
11	.200	.264	0.271	6.992	.091	1.361	8.100	.014	.009	.006	52.638
12	.220	.293	0.301	7.120	.103	1.456	8.508	.015	.011	.006	59.747
13	.240	.332	0.341	7.159	.118	3.197	6.669	.033	.034	.041	163.035
14	.260	.424	0.435	6.993	.147	6.050	6.256	.062	.061	.234	225.632
15	.280	.574	0.589	6.785	.179	8.897	6.109	.091	.086	.597	237.087
16	.300	.780	0.800	6.595	.209	11.741	6.038	.120	.112	1.034	226.839
17	.320	1.042	1.069	6.449	.234	14.583	5.995	.150	.137	1.502	207.942
18	.340	1.363	1.398	6.337	.257	17.420	5.968	.179	.163	1.974	188.328
19	.360	1.739	1.784	6.255	.277	20.238	5.951	.208	.187	2.445	169.953
20	.380	2.172	2.228	6.193	.295	23.058	5.939	.237	.212	2.911	154.365
21	.400	2.661	2.730	6.146	.313	25.874	5.932	.265	.238	3.364	141.040
22	.420	3.206	3.289	6.109	.330	28.688	5.927	.294	.263	3.815	129.411
23	.440	3.808	3.907	6.079	.346	31.498	5.924	.323	.288	4.255	119.361
24	.460	4.470	4.586	6.058	.361	34.296	5.923	.352	.313	4.686	110.514
25	.480	5.185	5.320	6.039	.375	37.089	5.923	.381	.338	5.112	102.900
26	.500	5.956	6.111	6.024	.390	39.885	5.923	.409	.363	5.534	96.211
27	.520	6.781	6.957	6.013	.405	42.501	5.951	.436	.384	5.841	89.523
28	.540	7.657	7.856	6.009	.420	44.907	5.993	.461	.403	6.056	83.171
29	.560	8.574	8.797	6.012	.433	46.746	6.072	.480	.417	6.018	76.852
30	.580	9.523	9.771	6.022	.447	48.005	6.157	.493	.432	5.746	71.569
31	.600	10.495	10.768	6.039	.461	49.104	6.238	.504	.446	5.466	67.045
32	.620	11.489	11.788	6.060	.474	50.047	6.312	.513	.464	5.195	63.714
33	.640	12.497	12.822	6.083	.486	50.804	6.375	.521	.477	4.938	60.238
34	.660	13.524	13.876	6.108	.498	51.588	6.439	.529	.490	4.670	57.182
35	.680	14.566	14.945	6.134	.511	52.390	6.501	.538	.503	4.472	54.477
36	.700	15.616	16.022	6.160	.523	52.954	6.548	.543	.513	4.235	51.826
37	.720	16.687	17.121	6.186	.535	53.503	6.593	.549	.523	4.038	49.530
38	.740	17.764	18.226	6.212	.546	54.061	6.638	.555	.534	3.868	47.489
39	.760	18.840	19.330	6.236	.558	54.612	6.682	.560	.545	3.721	45.679
40	.780	19.934	20.452	6.261	.570	55.117	6.722	.566	.554	3.590	43.900
41	.800	21.038	21.585	6.285	.582	55.655	6.764	.571	.565	3.475	42.379
42	.820	22.167	22.743	6.312	.593	56.194	6.805	.577	.575	3.362	40.945
43	.840	23.285	23.890	6.334	.604	56.797	6.852	.583	.585	3.242	39.666
44	.860	24.424	25.059	6.358	.616	57.143	6.876	.586	.593	3.127	38.353
45	.880	25.571	26.236	6.382	.627	57.537	6.905	.590	.603	3.022	37.223
46	.900	26.725	27.420	6.405	.639	57.934	6.935	.594	.610	2.927	36.050
47	.920	27.891	28.616	6.428	.650	58.320	6.963	.598	.618	2.834	34.998
48	.940	29.059	29.815	6.449	.661	58.702	6.989	.602	.631	2.755	34.260
49	.960	30.235	31.021	6.470	.673	59.079	7.013	.606	.638	2.681	33.316
50	.980	31.417	32.234	6.490	.684	59.456	7.038	.610	.644	2.614	32.358
51	1.000	32.608	33.456	6.509	.695	59.834	7.062	.614	.652	2.552	31.554
52	1.020	33.814	34.693	6.530	.706	60.212	7.085	.618	.658	2.494	30.746
53	1.040	35.022	35.933	6.549	.717	60.518	7.104	.621	.666	2.440	30.029
54	1.060	36.238	37.180	6.569	.729	60.885	7.127	.625	.674	2.390	29.360
55	1.080	37.506	38.481	6.598	.740	61.295	7.155	.629	.681	2.341	28.674
56	1.100	38.740	39.747	6.617	.751	61.678	7.179	.633	.690	2.299	28.108



LA	CM	VOL	DES	PPC		FLT	PPF		Tc	Mu	RMT	RML
				XC	KC		XLA	TON	MOM			
57	1.120	39.992	41.032	6.634	.762	61.988	7.197	.636	.696	2.248	27.493	
58	1.140	41.239	42.311	6.652	.773	62.305	7.216	.639	.702	2.201	26.877	
59	1.160	42.429	43.597	6.669	.784	62.629	7.235	.643	.709	2.157	26.345	
60	1.180	43.751	44.889	6.686	.796	62.950	7.254	.646	.716	2.112	25.843	
61	1.200	45.016	46.186	6.703	.807	63.271	7.273	.649	.723	2.072	25.370	
62	1.220	46.287	47.490	6.719	.818	63.578	7.291	.652	.731	2.035	24.924	
63	1.240	47.563	48.800	6.734	.829	63.906	7.310	.656	.738	1.999	24.503	
64	1.260	48.846	50.116	6.750	.840	64.237	7.329	.659	.746	1.965	24.103	
65	1.280	50.135	51.439	6.765	.851	64.571	7.349	.662	.753	1.934	23.725	
66	1.300	51.430	52.767	6.780	.862	64.907	7.369	.666	.761	1.904	23.365	
67	1.320	52.731	54.102	6.794	.873	65.293	7.392	.670	.769	1.872	23.023	
68	1.340	54.034	55.439	6.809	.884	65.507	7.400	.672	.779	1.846	22.762	
69	1.360	55.347	56.786	6.823	.895	65.822	7.417	.675	.786	1.821	22.437	
70	1.380	56.666	58.139	6.837	.906	66.131	7.434	.679	.793	1.796	22.090	
71	1.400	57.969	59.476	6.847	.918	66.433	7.450	.682	.802	1.772	21.831	
72	1.420	59.300	60.842	6.861	.929	66.731	7.465	.685	.808	1.749	21.521	
73	1.440	60.637	62.214	6.874	.940	67.027	7.480	.688	.815	1.726	21.219	
74	1.460	61.979	63.590	6.887	.951	67.322	7.495	.691	.823	1.704	20.956	
75	1.480	63.327	64.974	6.900	.962	67.615	7.509	.694	.829	1.683	20.671	
76	1.500	64.681	66.363	6.913	.973	67.907	7.524	.697	.835	1.662	20.394	
LA	CM	VOL	DES	XC	KC	FLT	XLA	TON	MOM	RMT	RML	

- LA Línea de agua
- CM Calado medio
- VOL (m3) Volumen de carena
- DES (Tm) Desplazamiento
- XC (m) *PPC* Abcisa del Centro de Carena desde la perpendicular de popa
- KC (m) Ordenada del Centro de Carena desde la base
- FLT (m2) Área de las Flotaciones
- XLA (m) Abcisa del Centro de Flotación desde la perpendicular de popa *PPF*
- TON 1cm. Toneladas por centímetro de inmersión *Tc*
- MOM 1cm. *Mu* Momento unitario o momento para variar el asiento 1 centímetro
- RMT (m) Radio metacéntrico transversal *CM*
- RML (m) Radio metacéntrico longitudinal

Curvas pantocarenas (en metros *KN*)

D (Tm)	5°	10°	15°	20°	30°	40°	50°	60°
22	.349	.669	.928	1.144	1.496	1.810	2.084	-----
24	.331	.650	.911	1.128	1.483	1.804	2.083	-----
26	.320	.636	.893	1.114	1.477	1.802	2.078	2.170
28	.308	.613	.875	1.101	1.471	1.800	2.072	2.163
30	.297	.592	.865	1.088	1.464	1.798	2.063	2.147
32	.290	.581	.850	1.075	1.458	1.794	2.053	2.142
34	.283	.565	.834	1.064	1.453	1.795	2.040	2.131
36	.274	.552	.820	1.056	1.449	1.788	2.026	2.121
38	.269	.541	.810	1.045	1.446	1.784	2.009	2.106
40	.264	.528	.793	1.035	1.443	1.781	1.996	2.095
42	.259	.522	.783	1.025	1.440	1.776	1.983	2.083
44	.256	.514	.771	1.017	1.438	1.770	1.973	2.071
46	.253	.507	.760	1.010	1.435	1.764	1.961	2.058
48	.248	.498	.751	1.001	1.432	1.758	1.949	2.039
50	.245	.492	.743	.992	1.429	1.751	1.938	2.023
52	.243	.489	.734	.984	1.425	1.745	1.926	2.005
54	.241	.483	.727	.978	1.421	1.736	1.914	1.991
56	.238	.477	.721	.969	1.416	1.728	-----	-----

D (Tm) 5° 10° 15° 20° 30° 40° 50° 60°

KN