The curves are obtained from a large number of one dimensional dynamic analyses, i.e. on flat seabed and neglecting bending and axial deformation of the pipe.

One should note that all cases with high values of *N*, *K* and *M* do not necessarily represent realistic physical conditions. The given values are not valid for extreme cases requiring a pipe specific weight s_g larger than 3. Neither should this method be used for $s_g < 1.05$. The specific weight of a pipe is given by:

$$s_g = 1 + \frac{2}{\pi} \cdot N \cdot K \cdot L \qquad (3.33)$$

At deep waters, *K* may be very small whereas the presence of current gives a large value of *M*. In such cases it is recommended to require absolute stability according to [3.6].

L_{stable} is independent of sea state duration whereas L_{10} is valid for 1 000 waves and can be assumed to be proportional to the number of waves τ in the sea state. If $L < L_{stable}$, then displacement should conservatively be regarded as varying linearly with number of waves in the sea state:

$$Y_\tau = 0.5 + (10 - 0.5) \cdot \frac{\tau}{1000} = 0.5 + 0.0095 \cdot \tau \qquad (3.34)$$

E.g. a three hour sea state with $T_u > 10.8$ s will expose the pipe to less than 1 000 waves, and the expected displacement can be scaled down accordingly.

Linear interpolation can be performed in *M* and *K*.

Required weight for an intermediate displacement criterion can be calculated according to the following formula:

$$\log L_Y = \log L_{stable} + \frac{\log\left(L_{stable5} / L_{10}\right)}{\log\left(0.5/(0.01 \cdot \tau)\right)} \cdot \log\left(Y / 0.5\right) \qquad (3.35)$$

This design approach is applicable to $N \le 0.024$ for clay and $N \le 0.048$ for sand.

Interpolation can be performed in G_c for clay assuming *L* to be proportional with $\sqrt{G_c}$. (The effect of varying soil density for pipes on sand has been neglected.) Note that the curves are valid for $G_c \le 2.78$ only. For higher values of G_c it is recommended to require absolute stability.

Minimum pipe weight required to obtain a virtually stable pipe can found from the following design points independent of *N*:

Table 3-2 Minimum weight, $L_{stable}/(2 + M)^2$, for pipe on sand, $K \ge 10$

K *M*	*10*	*15*	*20*	*30*	*40*	*≥ 60*
≤ 0.2	1.50	1.42	1.35	1.25	1.22	1.22
0.4	1.82	1.70	1.61	1.53	1.50	1.50
0.5	2.19	1.97	1.83	1.69	1.61	1.61
0.6	2.65	2.35	2.18	1.99	1.85	1.72

K *M*	*10*	*15*	*20*	*30*	*40*	*≥ 60*
0.8	3.05	2.55	2.32	2.13	2.01	1.90
1.0	3.05	2.55	2.40	2.20	2.06	1.95
1.5	2.65	2.45	2.36	2.24	2.11	2.09
2.0	2.50	2.40	2.35	2.27	2.22	2.19
4.0	2.45	2.40	2.39	2.37	2.37	2.37
≥ 10	2.50	2.50	2.50	2.50	2.50	2.50

For $K \leq 5$, the required weight is more dependant on N and minimum pipe weight required to obtain a virtually stable pipe can found from the following design points:

Table 3-3 Minimum weight, $L_{stable}/(2 + M)^2$, for pipe on sand, $K \leq 5$

N *M*	*0.003*	*0.006*	*0.012*	*0.024*	*0.048*
≤ 0.2	1.55	1.45	1.34	1.24	1.13
0.4	2.00	1.65	1.34	1.24	1.13
0.5	3.30	2.60	1.91	1.24	1.13
0.6	3.75	3.07	2.38	1.70	1.13
0.8	4.00	3.45	2.90	2.36	1.81
1.0	3.90	3.50	3.10	2.71	2.31
1.5	3.25	3.13	3.00	2.88	2.75
2.0	2.75	2.75	2.75	2.75	2.75
4.0	2.60	2.60	2.60	2.60	2.60
≥ 10	2.50	2.50	2.50	2.50	2.50

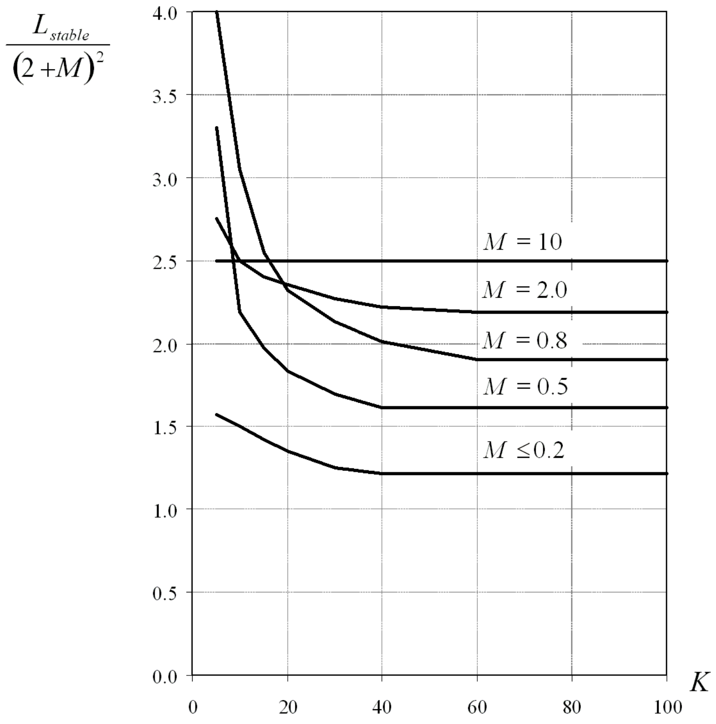

Figure 3-11 Minimum weight, $L_{stable}/(2 + M)^2$, for pipe on sand

Minimum pipe weight required to limit the lateral displacement to 10 pipe diameters for pipes on sand can found from the following design points:

Table 3-4 Minimum weight, $L_{10}/(2 + M)^2$, for pipe on sand

K *M*	*= 5*	*10*	*15*	*20*	*30*	*40*	*60*	*≥ 100*
≤ 0.2	0.20	0.41	0.61	0.81	0.69	0.69	0.69	0.69
0.4	0.31	0.62	0.93	0.81	0.75	0.72	0.70	0.70
0.5	0.34	0.69	1.03	0.93	0.83	0.78	0.75	1.00
0.6	0.79	1.20	1.13	1.10	1.07	1.05	1.03	1.02
0.8	0.85	1.40	1.37	1.35	1.33	1.33	1.32	1.31
1.0	1.60	1.50	1.47	1.45	1.43	1.43	1.42	1.41
1.5	1.80	1.70	1.67	1.65	1.63	1.63	1.62	1.61
2.0	1.90	1.80	1.77	1.75	1.73	1.73	1.72	1.71
4.0	2.10	2.00	1.97	1.95	1.93	1.93	1.92	1.91
≥ 10	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50