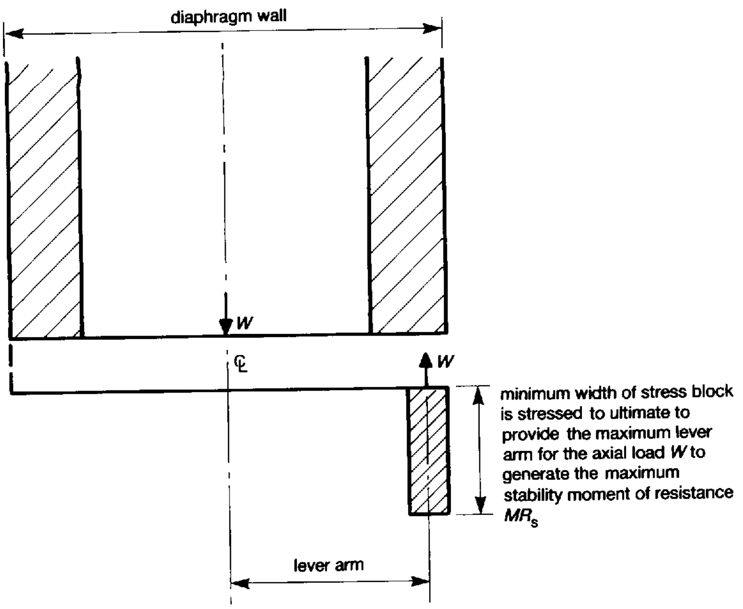


Figure 24: Rectangular stress block associated with maximum lever arm

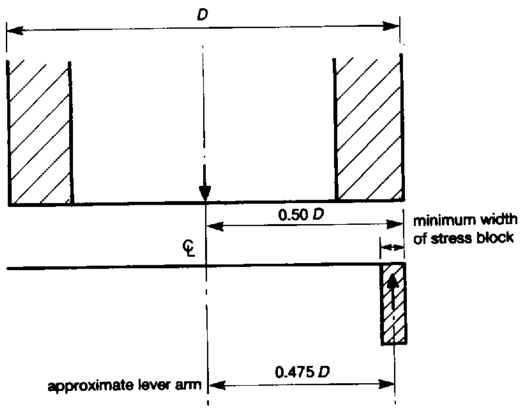


Figure 25: Approximate lever arm based on experience

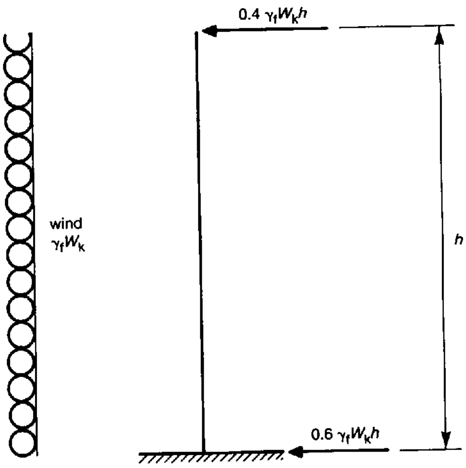


Figure 26: Reactions at base and prop level

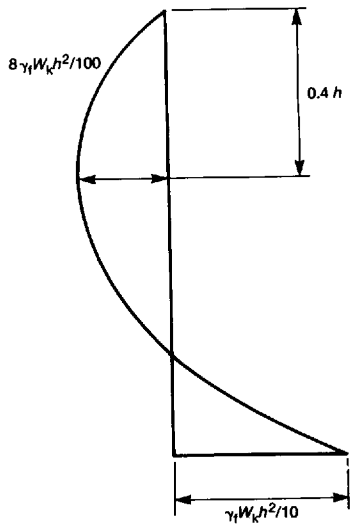


Figure 27: Modified bending moment

wall on the flexural compressive stress. The whole of the width of the wall's flange (or leaf) may be subject to the flexural compressive stress and in this situation, the possibility of local buckling of the flange must be allowed for in the assessment of the allowable flexural compressive stress. The formula for flexural compressive stress is therefore written as 1.1 $\beta f_k/\gamma_m$ where β is the capacity reduction factor in respect of the local buckling condition, and the expression is termed *allowable flexural compressive stress*, f_{ubc}.

2.4.4 *Trial section coefficients* K_2 *and* Z

The symmetrical profile of the diaphragm wall permits a simple method of arriving at a trial section. This considers the two critical conditions that exist in the 'propped cantilever' action of the analysis. Condition (1) occurs at the base of the wall – the applied bending moment at this level must not exceed the stability moment of resistance of the wall. Condition (2) occurs at approximately 3/8 h down from the top of the wall – the flexural tensile stresses are a maximum at this level and must not exceed those allowable through calculation.

Consider the two conditions:

Condition (1) at base of wall

The trial section analysis is simplified by assuming that there is no flexural tension at this level and that the mass contributing to the MR_s comprises only the self weight of the masonry.

BM at base level $= \gamma_f W_k h^2/8$ (1)

MR_s at base level = area x height x $\rho \times \gamma_f \times 0.475D$

$= 0.475\ (Ah\gamma_f D\rho)$ (2)

Equating (1) and (2),

$\gamma_f W_k h^2/8 \leqslant 0.475\ (Ah\gamma_f D\rho)$

γ_f for wind and dead loads will be taken as 1.4 and 0.9 respectively.

Hence $0.175\ W_k h^2 \leqslant 0.4275\ (AhD\rho)$

Let $K_2 = 0.4275\ AD\rho$

Then $h \leqslant 5.714\ K_2/W_k$ (3)

Example:

For the concrete blockwork diaphragm wall reference A in Section 2.3:

$K_2(15) = 0.4275 \times 0.2261 \times 0.435 \times 15$

$=0.631$ kN per metre length of wall for blocks with a density of 1500 kg/m^3

$K_2(20) = 0.4275 \times 0.2261 \times 0.435 \times 20$
$= 0.841$ kN per metre length of wall for blocks with a density of 2000 kg/m^3

Condition (2) at 3/8 h below top of wall

BM at 3/8 h level $= 9\gamma_f W_k h^2/128$ (4)

Moment of resistance $= (f_{kx}/\gamma_m + g_d)Z$ (5)

Equating (4) and (5),

$9\gamma_f W_k h^2/128 \leqslant (f_{kx}/\gamma_m + g_d)Z$

The trial section analysis is further simplified by assuming that flexural tensile stresses control; $\gamma_m = 2.5$; $f_{kx} = 0.25$ N/mm^2; ρ for concrete blockwork is 1500 kg/m^3.

By substitution,

$9 \times 1.4 \times W_k h^2/128 \leqslant (0.25 \times 10^3/2.5 + 0.9 \times 15 \times 3 \times h/8)Z$

from which,

$Z \doteq W_k h^3/(1000 + 50.6\,h)$ (6)

Two graphs have been plotted for equations (3) and (6) and for various values of W_k (see Figures 28 and 29).

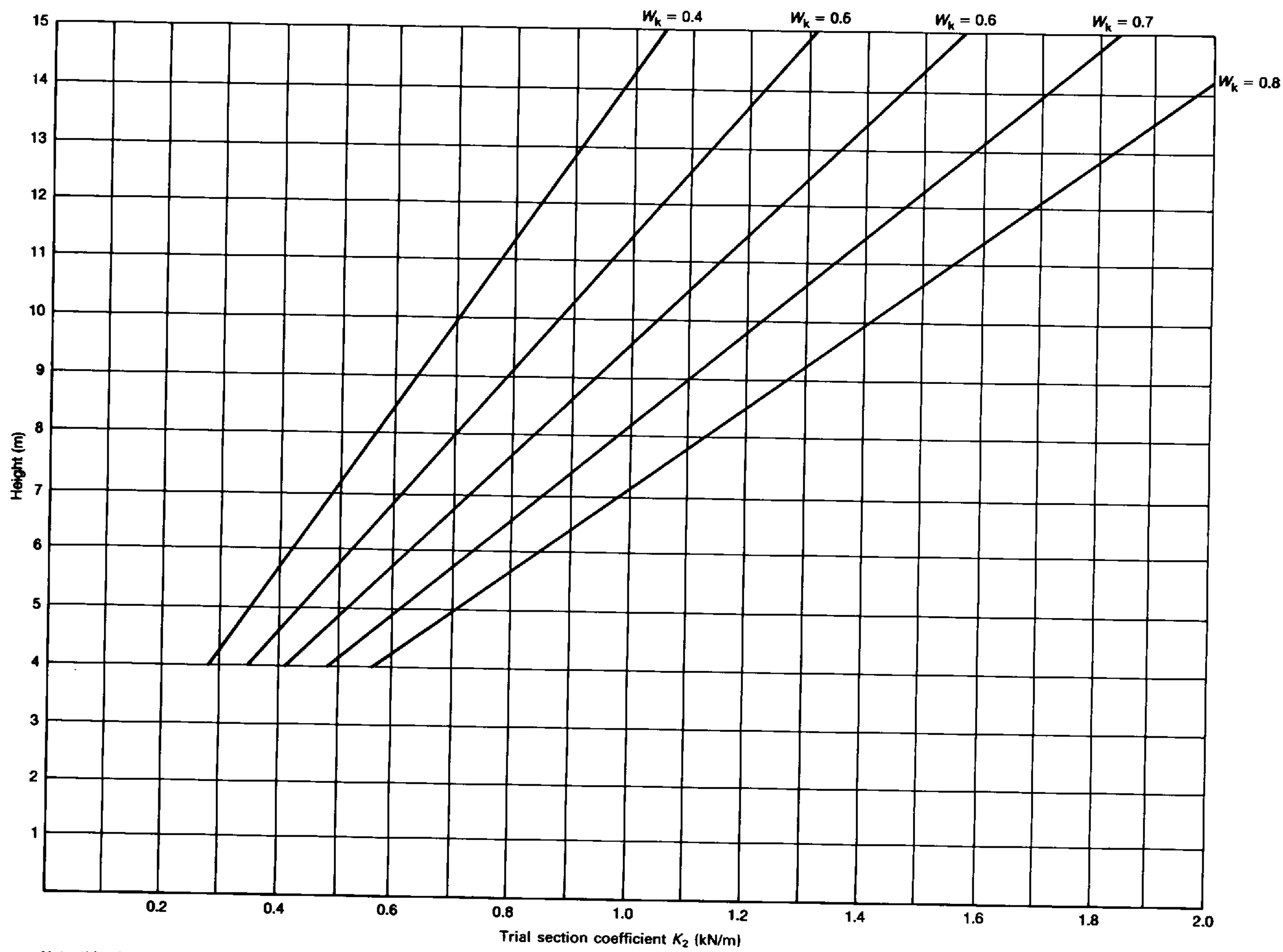
For a known wall height and wind pressure, values of K_2 and Z may be read from the graphs and, using Tables 1 or 2, the most suitable section can be obtained for full analysis. It should be remembered that the two trial section graphs have been drawn assuming fixed conditions for a number of variable quantities which are summarized thus:

(a) the wall acts as a true propped cantilever;
(b) there is no transfer of tension at the base;
(c) vertical roof loads (downward or uplift) are ignored;
(d) γ_m is taken as 2.5;
(e) f_{kx} is taken as 0.25 N/mm^2;
(f) density of blockwork is taken as 1500 kg/m^3;
(g) K_2 values are calculated using the approximate lever arm method.

The trial section graphs should be used only for the purpose of obtaining a trial section, and a full analysis of the selected section should always be carried out.

2.4.5 Shear stress coefficient K_1

It is also necessary to check the vertical shear stress at the junction of the cross-ribs and the leaves (see Figure 30).



Note: this trial section graph is based on the loading combination of dead plus wind for which the partial safety factors on loads are taken as 0.9 and 1.4 respectively

Figure 28: Graph to determine K_2