4 Masonry elements

4.1 Structural design of masonry

The structural design of masonry is carried out in accordance with the guidance given in BS 5628 'Code of practice for use of masonry'. This is divided into the following three parts:

Part 1 Structural use of unreinforced masonry.

Part 2 Structural use of reinforced and prestressed masonry.

Part 3 Materials and components, design and workmanship.

The design of masonry dealt with in this manual is based on Part 1, which gives design recommendations for unreinforced masonry constructed of bricks, concrete blocks or natural stone.

When an unreinforced wall is found to be inadequate, consideration may be given to adding reinforcement or even prestressing the masonry. In such circumstances the calculations would be based upon the recommendations given in Part 2 of the code.

Guidance is given in the code on the design of walls to resist lateral loading, such as that resulting from wind loads, as well as vertical loading. However, this manual will concentrate on the design of vertically loaded walls.

4.2 Symbols

Those symbols used in BS 5628 that are relevant to this manual are as follows:

A horizontal cross-sectional area
b width of column
e_x eccentricity at top of a wall
f_k characteristic compressive strength of masonry
G_k characteristic dead load
g_A design vertical load per unit area
g_d design vertical dead load per unit area
h clear height of wall or column between lateral supports
h_{ef} effective height of wall or column
K stiffness coefficient
L length
l_{ef} effective length of wall
Q_k characteristic imposed load
t overall thickness of a wall or column
t_{ef} effective thickness of a wall or column
t_p thickness of a pier
t_1 thickness of leaf 1 of a cavity wall

t_2 thickness of leaf 2 of a cavity wall
β capacity reduction factor for walls and columns allowing for effects of slenderness and eccentricity
γ_f partial safety factor for load
γ_m partial safety factor for material

4.3 Definitions

The following definitions which are relevant to this manual have been abstracted from BS 5628 Part 1:

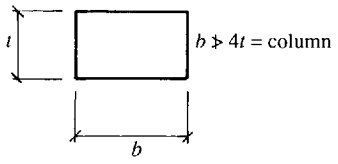

Figure 4.1 *Definition of a column*

Column An isolated vertical load bearing member whose width is not more than four times its thickness, as illustrated in Figure 4.1.

Effective height or length The height or length of a wall, pier or column assumed for calculating the slenderness ratio.

Effective thickness The thickness of a wall, pier or column assumed for calculating the slenderness ratio.

Lateral support The support, in relation to a wall or pier, which will restrict movement in the direction of the thickness of the wall or, in relation to a column, which will restrict movement in the direction of its thickness or width. Lateral supports may be horizontal or vertical.

Load bearing walls Walls primarily designed to carry an imposed vertical load in addition to their own weight.

Masonry An assemblage of structural units, either laid *in situ* or constructed in prefabricated panels, in which the structural units are bonded and solidly put together with mortar or grout. Masonry may be reinforced or unreinforced.

Pier A member which forms an integral part of a wall, in the form of a thickened section placed at intervals along the wall.

Slenderness ratio The ratio of the effective height or effective length to the effective thickness.

Structural units Bricks or blocks, or square dressed natural stone.

Single leaf wall A wall of bricks or blocks laid to overlap in one or more directions and set solidly in mortar.

Double leaf (collar jointed) wall Two parallel single leaf walls, with a space between not exceeding 25 mm, filled solidly with mortar and so tied together as to result in common action under load.

Cavity wall Two parallel single leaf walls, usually at least 50 mm apart, and effectively tied together with wall ties, the space between being left as a continuous cavity or filled with non-load-bearing material.

Faced wall A wall in which the facing and backing are so bonded as to result in common action under load.

Veneered wall A wall having a facing which is attached to the backing, but not so bonded as to result in common action under load.