

SECTION 6. SLENDERNESS RATIO

Slenderness ratio is the ratio of the effective height or effective length of a wall or pier divided by the effective thickness. It provides a means of measuring the robustness of a structural member, and it is used in calculations to adjust the capacity of a structural member to account for the possibility of buckling causing a premature mode of failure.

6.1 Unreinforced *mortarless* to BS 5628-1:2005

BS 5628-1:2005 Clause 24.1 stipulates that the slenderness ratio of all walls greater than 90mm thick should not exceed 27.

Clause 24.2 requires that lateral supports, either vertical or horizontal, be designed to withstand 2.5% of the design vertical load plus any directly applied loads. The lateral supports must transmit the loads to the elements of the structure that provide stability.

Effective height of walls:

BS 5628-1:2005 Clause 24.3.2.1 states that the effective height of a wall may be taken as

- 0.75 times the clear distance between lateral supports where the lateral supports provide enhanced resistance to lateral movement, or
- 1.0 times the clear distance between lateral supports where the lateral supports provide simple resistance to lateral movement.

Effective height of columns:

BS 5628-1:2005 Clause 24.3.2.2 states that the effective height of a column should be taken as

- 1.0 times the clear distance between lateral supports, or
- twice the height of the column in respect of a direction in which lateral support is not provided.

Effective height of columns formed by adjacent openings in walls:

Where openings occur in walls such that the masonry between any two openings is by definition a column (i.e. where the width is not more than four times the thickness)

- where the wall containing the column has enhanced resistance to lateral movement, 0.75 times the clear distance between lateral supports plus 0.25 times the height of the taller of the two openings, or
- where the wall containing the column has simple resistance to lateral movement, 1.0 times the clear distance between lateral supports where the lateral supports provide simple resistance to lateral movement.

In the above, enhanced resistance to lateral movement can be assumed to exist where:

- a) floors or roofs of any form of construction span onto the wall or column from both sides at the same level;
- b) an insitu concrete floor or roof, or a precast concrete floor or roof giving equivalent restraint, irrespective of the direction of the span, has a bearing of at least one half the thickness of the wall or column onto which it spans but in no case less than 90mm;
- c) in the case of houses of not more than three storeys, a timber floor spans onto a wall from one side and has a bearing of not less than 90mm.

Note that it is also recommended in Clause 24.2.3.2 that columns be provided with lateral support in both horizontal directions.

BS 5628-1:2005 Clause 24.2.3.1 states that simple resistance to lateral movement may be assumed in the case of houses of not more than three storeys where the connections between structural elements conform to BS 8103-1. In all other cases, including buildings of more than three storeys, a connection capable of providing simple resistance to lateral movement may be assumed where connections are of the form illustrated in BS 5628-1:2005 Annex D.

Effective length of walls:

BS 5628-1:2005 Clause 24.3.3 states that the effective length of a wall may be taken as:

- 0.75 times the distance between vertical lateral supports where lateral supports provide enhanced resistance to lateral movement, or
- twice the distance between a support and a free edge where lateral support provides enhanced resistance to lateral movement, or
- the clear distance between lateral supports where lateral supports provide simple resistance to lateral movement, or
- 2.5 times the distance between a support and a free edge where the lateral support provides simple resistance to lateral movement.

Effective thickness:

BS 5628-1:2005 Clause 24.4.2 states that the effective thickness of a single leaf wall or column is the actual thickness.

When walls are stiffened with engaged piers, the effective thickness is the actual thickness multiplied by a stiffness coefficient given in the Table 5. The coefficient varies from 1.0 minimum to 2.0 maximum.

6.2 Reinforced *mortarless* to BS 5628-2:2005

Clause 8.3.2.1 stipulates that the slenderness ratio of reinforced walls and columns should also not exceed 27, except for cantilever walls and columns in which case the slenderness ratio should not exceed 18. This clause also requires that special consideration be given to deflection where the percentage of reinforcement in cantilevered walls or columns (calculated using the effective depth) exceeds 0.5%.

Effective height of walls:

Same as for unreinforced *mortarless*. (see above) Refer BS 5628-2:2005 Clause 8.3.2.3
Note that this clause states the effective height of a wall should preferably be assessed by structural analysis.

Effective height of columns:

Same as for unreinforced *mortarless*. (see above) Refer BS 5628-2:2005 Clause 8.3.2.3
Note that this clause states the effective height of a column should preferably be assessed by structural analysis.

Effective thickness:

Same as for unreinforced *mortarless*. (see above) Refer BS 5628-2:2005 Clause 8.3.2.4