SECTION 11. DESIGN FOR SHEAR

As all ***mortarless*** walls are grouted and at least lightly reinforced, it is assumed that all walls are considered reinforced for the purposes of bending and shear resistance.

11.1 Shear resistance of reinforced *mortarless* members in bending

BS 5628-2:2005 Clause 8.2.5 provides the rules for shear strength and shear reinforcement.

The design shear resistance of a ***mortarless*** masonry member in bending is calculated as follows:

$$V_d = f_v \, b \, d / \gamma_{mv}$$

Where: b = the width of the member; and

d = is the effective depth

If the design shear force in the member is less than the design shear resistance, then generally no shear reinforcement is required.

If the design shear force in the member is greater than the design shear resistance, then shear reinforcement should be provided and the following recommendation should be observed:

$$A_{sv} / s_v < (b (v - f_v / \gamma_{mv}) \gamma_{ms}) / f_y$$

Where: A_{sv} = the cross-sectional area of the shear reinforcement;

b = the width of the section;

f_v = the characteristic shear strength of the masonry;

f_y = the characteristic tensile strength of the shear reinforcement;

s_v = the spacing of the shear reinforcement along the member, provided it is not taken to be greater than 0.75 *d*.

v = the shear stress due to the design loads, provided it is not taken to be greater than 2.0 / γ_{mv} MPa

γ_{ms} = the partial safety factor for strength of steel;

γ_{mv} = the partial safety factor for shear strength of masonry.

11.2 Shear resistance of reinforced *mortarless* members subject to in-plane shear

BS 5628-2:2005 Clause 8.5 provides the rules for in-plane shear strength and shear reinforcement.

The design racking shear resistance of a vertically reinforced ***mortarless*** masonry wall acting as a shear wall is:

$$V_d = f_v b_b L / \gamma_{mv}$$

Where: b_b = the bedded width of the wall; and

L = is the length of the wall

If the design racking shear force in the member is less than the design shear resistance, then it can be assumed that there is adequate provision against the ultimate limit state shear being reached.

If the design racking shear force in the member is greater than the design racking shear resistance, then horizontal shear reinforcement should be provided and the following recommendation should be observed:

$$A_{sv} \geq (L\, b_b (v - f_v / \gamma_{mv})) / (f_y / \gamma_{ms})$$ but in no case should v exceed $2.0 / \gamma_{mv}$

Where: A_{sv} = the cross-sectional area of the shear reinforcement;

L = the length of the wall;

b_b = the bedded width of the section;

f_v = the characteristic tensile strength of the masonry;

f_y = the characteristic tensile strength of the shear reinforcement;

v = the shear stress due to the design loads, provided it is not taken to be greater than $2.0 / \gamma_{mv}$

γ_{ms} = the partial safety factor for strength of steel;

γ_{mv} = the partial safety factor for shear strength of masonry.

11.3 Minimum shear reinforcement in *mortarless* beams

BS5628-2 Clause 8.6.4 specifies the maximum spacing in the direction of the span of shear reinforcement, when required, to be 0.75*d* where *d* is the effective depth.

BS 5628-2:2005 Clause 8.6.5.2 specifies the following minimum requirements for the beam links when nominal shear reinforcement is required under the requirements Clause 8.2.5.1:

$$\frac{A_{sv}}{s_v} = 0.002\, b_t \quad \text{for mild steel, or}$$

$$\frac{A_{sv}}{s_v} = 0.0012\, b_t \quad \text{for high yield steel}$$

where A_{sv} is the cross-sectional area of reinforcing steel resisting shear forces

b_t is the width of the beam at the level of the tension reinforcement

s_v is the spacing of the shear reinforcement which should not exceed 0.75*d*

BS 5628-2:2005 Clause 8.6.5.1 specifies the following minimum requirements for anchorage of beam links:

A link may be considered to be fully anchored if it passes around another bar of at least its own diameter through an angle of 90^o and continues beyond for a minimum length of eight times its own diameter, or through 180^o and continues for a minimum length of four times its own diameter. In no case should the radius of any bend in a link be less than twice the radius of the test bend guaranteed by the manufacturer of the reinforcement.