SECTION 7. DESIGN OF *mortarless* WALLS FOR COMPRESSION

When designing ***mortarless*** walls and piers for compression loads the vertical reinforcement is not considered to make any contribution to the compressive strength simply because it cannot be restrained in two directions with ties at close centres. Tied column cages may be appropriate in larger freestanding masonry piers or columns, however there is no masonry unit manufactured in the ***mortarless*** range at present for such piers or columns.

It is normal practice when designing reinforced concrete walls to neglect any contribution the reinforcement might make to the compression load capacity however AS 3600 Clause 11.7.4 actually permits the contribution of unrestrained vertical reinforcement if the area of reinforcement in certain circumstances - refer 3.1 above. Regardless of this in all of the design aids in this manual any contribution of the reinforcement to the vertical load capacity has been ignored.

Design of *mortarless* walls in axial compression:

The design strength of a wall in compression is dependent on the following:

- Slenderness
- Effective eccentricity at the top
- Characteristic compressive strength of the masonry and the grout
- Cross sectional area of the masonry.

In ***mortarless*** wall construction the ***mortarless*** masonry units are permanent shutters or formwork that contribute just a little to the compressive strength of the wall. The design thickness is less than the total thickness; it is just the overall thickness of the grout (concrete core fill). The portion of the masonry face shells that have no provision for concrete penetration are ignored. In unchamfered ***mortarless*** that generally means that 26mm of the wall thickness is ignored and in chamfered ***mortarless*** it means that 36mm of the thickness is ignored.

AS 3600 Clause 11.2 outlines the design procedures for walls and there are various options:

For braced walls where there are in-plane horizontal forces acting in conjunction with axial forces and where these are such that a horizontal cross section of the wall is subject to compression over the entire section then the in-plane bending can be neglected and the wall designed for the horizontal shear forces as per Section 5 in the subsequent Parts of this design manual. In this circumstance the wall can be designed for vertical compression forces either

a) as a wall in accordance with the simplified procedure provided the slenderness ratio does not exceed 30, or
b) as a column in accordance with AS 3600 Section 10 with vertical reinforcement provided in both faces (but with no requirement to consider the contribution of the vertical reinforcement to the compression load capacity).

For braced walls that are subject to simultaneous in-plane and out-of-plane load effects, and for unbraced walls, AS 3600 Clause 11.1(b) required that they be designed as slabs in accordance with Section 9 or columns in accordance with Section 10 as appropriate.

It further states that where the stress at the mid-height section due to factored in-plane bending and axial forces does not exceed the lesser of 0.03f'c and 2MPa, then the wall may be designed as a slab in accordance with Section 9 provided:

i) the second-order deflections due to in-plane loads and long-term effects are considered in the calculation of bending moments, and
ii) the ratio of effective height to thickness does not exceed 50.

All of the axial compression load values in the design tables in the subsequent Parts of this manual have been calculated using the simplified method.

The values used in the interaction diagrams however have been calculated using column design formulae. When using the interaction diagrams it is essential that a proper analysis has been completed.

Simplified design method for walls in axial compression:

Note again that this method of design is permitted for walls in which the slenderness ratio does not exceed 30.

Clause 11.5.1 states that the design axial strength per unit length of a braced wall in compression can be taken as $\boldsymbol{\varnothing N_u}$

Where $\varnothing = 0.6$ and

$N_u = 0.6f'_c(t_w - 1.2e - 2e_a)$

In the above e is the eccentricity of the load measured at right angles to the plane of the wall, and e_a is the additional eccentricity taken as $(H_{we})^2/2500t_w$

The method of calculating the eccentricity e at the top of a wall when using the simplified method is given in Clause 11.5.2 and this is also shown in detail in the subsequent parts of this manual.

The minimum eccentricity on any wall designed using this method is 5% of the wall thickness, i.e.$0.05t_d$.

Design for compression in *mortarless* shear walls

When a load-bearing wall is also acting as a shear wall, in plane bending should be checked. When a horizontal force is resisted by more than one shear wall, the load may be distributed between the walls in proportion to their flexural stiffness about an axis perpendicular to the plane of the wall.

The in-plane bending moment will result in non-uniform compression in the wall and the wall should be designed for the maximum resulting compression force.

AS 3600 Clause 11.2.1 states that in-plane bending may be neglected in the case where the horizontal cross section is always under compression due to the combined effect of horizontal and vertical loads, and the wall be simply designed for axial load and for shear. It s recommended by the author however that the maximum compression in any wall due to the combined loading always be considered.

Clause 11.2.1 further states that if any part of a wall is subject to tension due to in-plane bending then the wall shall be designed for in-plane bending in accordance with Section 8 and for horizontal shear in accordance with Clause 11.6, or for in-plane bending and shear in accordance with Section 12 if appropriate.

Increased stresses at concentrated loads (bearing stress)

AS 3600 Clause 12.6 should be used for checking the bearing stress at load concentrations.