SECTION 4. DESIGN OF WALLS FOR AXIAL COMPRESSION COMBINED WITH OUT-OF-PLANE BENDING

Section 2 deals with the design of walls for axial compression loads with or without in-plane horizontal loads and in that section the axial load capacity is determined in accordance with the empirical design method outlined in IS 456:2000 Clause 32.2. The tabulated values in Section 2.1 take into account both the design eccentricity of the axial load and the additional eccentricity resulting from slenderness.

Walls can also be subjected to out of plane lateral loads however that may increase the design bending moments. While axial compression loads can increase the moment capacity of a wall it is important to check that the increased compressive stress in the extreme fibre of the concrete section does not exceed the allowable stress when the wall is subjected to the combined action. It is also essential to check that the walls is adequately reinforced for any flexural tensile stresses.

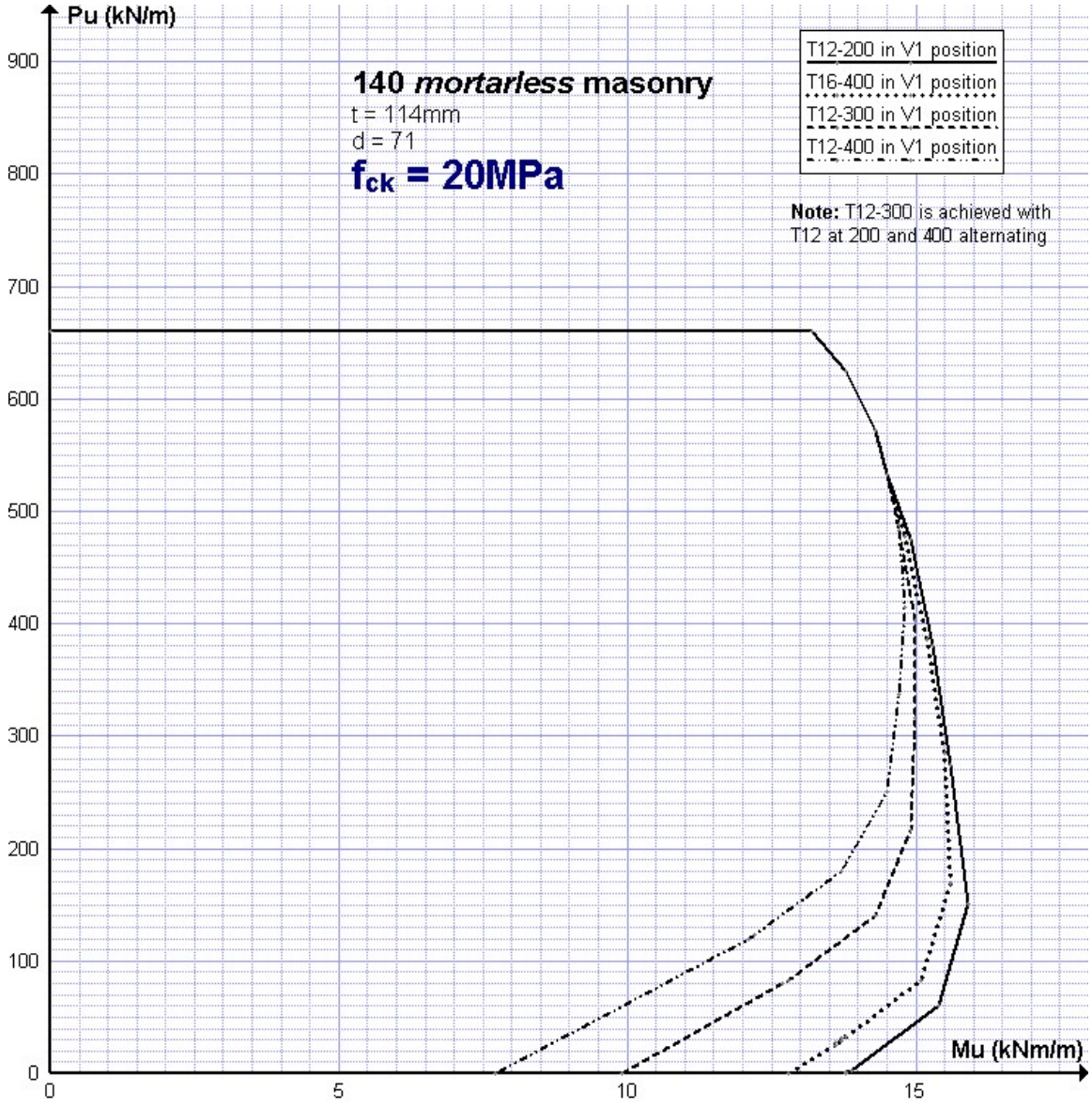
There is no provision in IS 456 for checking combined compression and bending due to out-of-plane lateral loads using the empirical design method. In this Section 4 of the design manual interaction diagrams are provided for that purpose and these diagrams can be used to determine whether or not a critical section is over stressed due to the combined action.

A proper structural analysis must be carried out to determine the design actions on the wall panel and when using the interaction diagrams it is very important to remember that the minimum design eccentricity is greater than that which applies when using the empirical design method. A minimum eccentricity of 20mm applies to all braced walls and the interaction diagrams have been truncated accordingly.

The reinforcement requirements for the wall panel can be determined using the interaction diagrams.

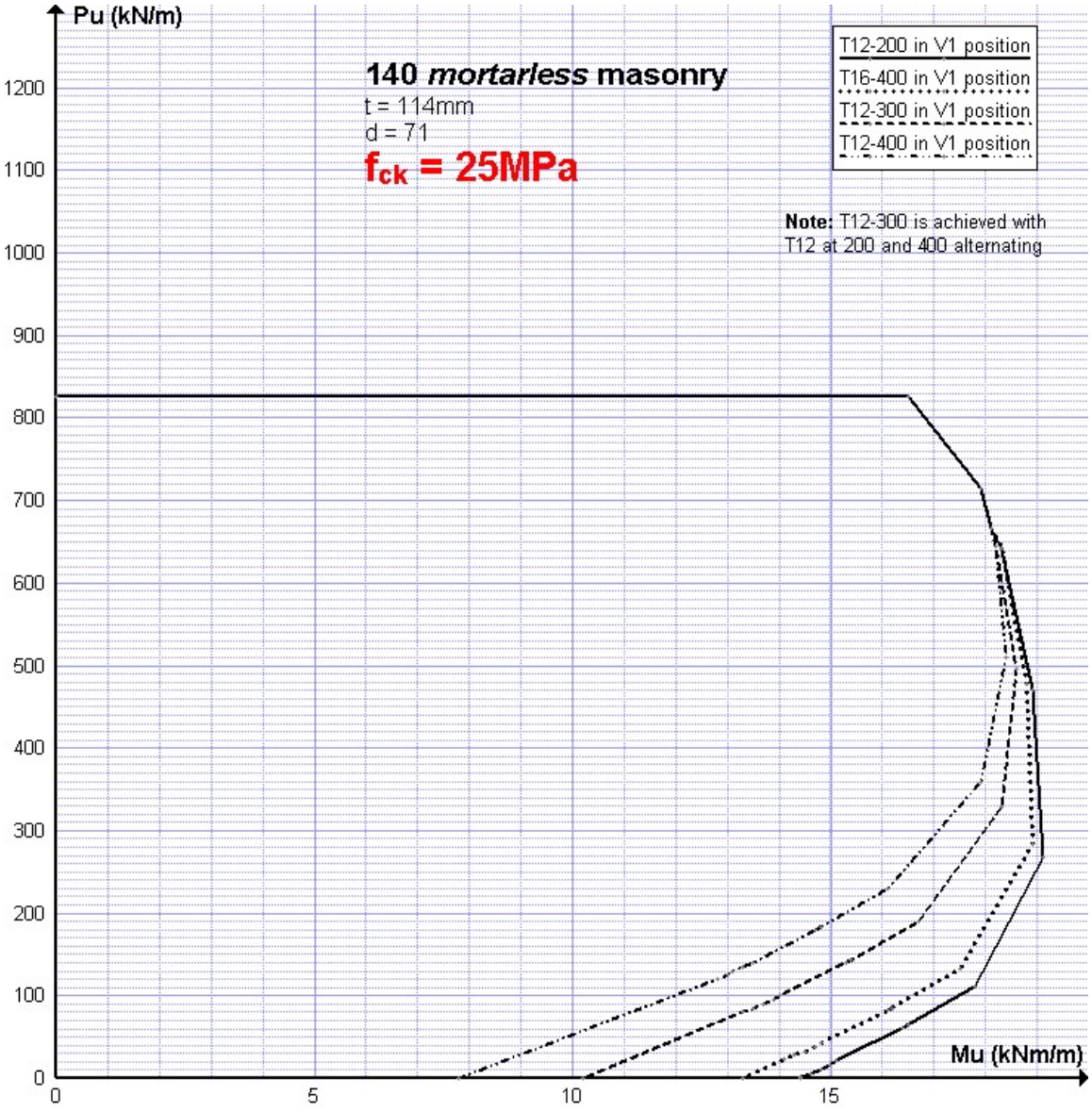
Design engineers must take into consideration the requirement of Clause 32.1 to provide vertical reinforcement in both faces.

DIAGRAM 4-1



Notes:
This interaction diagram is to be used for checking the adequacy of any critical cross section for the combined action of compression and out-of-plane bending.
Always ensure that the axial load used when checking for reinforcement requirements is the minimum sustained design axial compression load.
When using the chart enter with the design axial compression load P_u and read off the maximum design M_u.
The four reinforcement configurations shown in the diagram are the four options available when designing for flexure. Any increase in the reinforcement area will result in an over-reinforced section and this is not permissible.
Ensure that the vertical reinforcement is placed in the tension face of the wall in all cases.
Be aware of the requirement of Clause 32.1 to provide vertical reinforcement in both faces.

DIAGRAM 4-2



Notes:
This interaction diagram is to be used for checking the adequacy of any critical cross section for the combined action of compression and out-of-plane bending.
Always ensure that the axial load used when checking for reinforcement requirements is the minimum sustained design axial compression load.
If using this diagram the recommended minimum strength of the masonry unit is 20Mpa.
When using the chart enter with the design axial compression load P_u and read off the maximum design M_u.
The four reinforcement configurations shown in the diagram are the four options available when designing for flexure. Any increase in the reinforcement area will result in an over-reinforced section and this is not permissible.
Ensure that the vertical reinforcement is placed in the tension face of the wall in all cases.
Be aware of the requirement of Clause 32.1 to provide vertical reinforcement in both faces.