MASONRY INSIGHTS

written in conjunction with International Masonry Institute

Stack Bond from a Structural Engineer's Perspective

Most times when a structural engineer designs a masonry wall, it is designed as running bond. This construction method yields good structural integrity with overlapped blocks. At times, however, a stack bond wall might be requested for aesthetic reasons. A masonry wall constructed with stack bond can have similar structural capacity to running bond, provided reinforcing requirements are met.

Stack Bond Construction

The general understanding of stack bond is a wall where the head joints in successive courses are aligned vertically. The technical definition is any wall where the overlap of a masonry unit over the block below is less than one quarter of the length of the block. Due to this, the Building Code Requirements for Masonry Structures as reported by the Masonry Standards Joint Committee (MSJC) treats stack bond as anything "other than running bond".

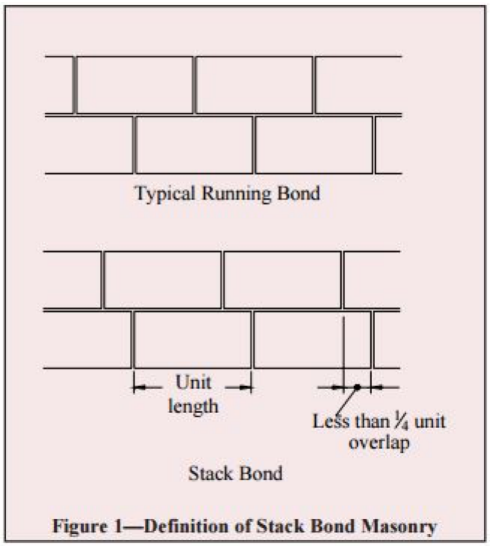

Figure 1—Definition of Stack Bond Masonry

From NCMA TEK 14-6

Properly reinforced stack bond walls can be as strong as walls constructed with running bond for most loading conditions. The TMS code requires the minimum area of horizontal reinforcement be 0.00028 times the gross vertical cross-sectional area of the wall. This can be accomplished with bond beams or reinforcement wire in the horizontal mortar joints. Whichever method is used, the maximum spacing of horizontal reinforcement is 48 inches. This reinforcing is meant to limit vertical cracking.

For walls spanning vertically, failure from out of plane loading occurs as bond failure between the block and the mortar in the horizontal joints. Since the horizontal joints are not any different between stack bond and running bonds, there is no difference in strength between these wall types when spanning vertically. The divergence occurs when the wall spans horizontally. In an unreinforced wall, the failure of running bond construction occurs as tension rupture of the blocks rather than as mortar failure. Because of this, running bond is about twice as strong when spanning horizontally as when spanning vertically. Stack bond walls have approximately the same strength whether spanning vertically or horizontally since the joints align in both directions. Horizontal reinforcing requirements mentioned above help to mitigate this strength discrepancy in horizontally spanning walls.

Another difference with stack bond construction is with concentrated loads. Compressive strength of the two construction types are essentially the same, but the distribution of the load is where the change comes in. In stack bond walls that have bond beams spaced at greater than 48 inches, the code allows the load to be distributed over the length of the masonry unit. Running bond walls and stack bond walls with bond beams spaced at no more than 48 inches use the unit overlap and the bond beams, respectively, to distribute the load to a larger width of wall — the lesser of the vertical bar spacing, six times the nominal wall thickness, or 72 inches.

Conclusion

Engineers need not worry if a client desires a stack bond structural wall. The code requires more reinforcing over and above that of a running bond wall, and still further reinforcing for stack bond walls in high seismic or hurricane areas. However, the inclusion of such reinforcing makes the stack bond wall essentially as strong as a running bond wall.