

The Strength of Hollow Masonry Walls Under Concentrated Vertical Loads

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Abstract:

Elastic finite element analyses of face-shell bedded hollow masonry wallettes subjected to concentrated loads have been carried out in an attempt to determine if cracking of the face-shells could initiate failure. The results confirmed the existence of tensile stresses in the webs which lead to web cracking at relatively low loads, but were insufficient to indicate if face-shells were likely to crack. An experimental investigation of the strength and failure modes of wallettes was then undertaken. Loads were applied along a length of wallette equal to the length of one half of a unit and with no deliberate out-of-plane eccentricity. The loads were applied at each end of each of two wallettes and centrally to two more wallettes. Relative displacements were measured along horizontal gauge lengths to detect face-shell cracking and through the thickness of the wallette to detect web cracking. The failure modes in all wallettes involved web cracking followed by mortar crushing in the bed joint below the load and then face-shell spalling at the bed joint---the same failure mode as in three high prisms. Some perpend joint cracking was detected, but face-shell cracking only occurred in the final stages of failure. The failure loads of end loaded wallettes is directly related to that of three high prisms. For wallettes loaded away from the end, the load capacity is approximately fifteen percent more than that of end-loaded wallettes. The increased bearing stresses allowed in codes for concentrated loads on solid masonry is not justified for face-shell bedded hollow masonry.

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