

# Failure Criterion for Laterally Loaded Masonry Walls

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## Abstract:

To design laterally loaded masonry walls due to wind loads or earth pressure by the theory of plasticity, the corresponding failure criterion is required. The behaviour and strength of a masonry wall element have been investigated experimentally and theoretically. A special rig was designed to test specimens measuring 2.1x1.2m subjected to bending in two directions, twisting moments and an axial force perpendicular to the bed joints. A particular effort was made to eliminate geometrical constraints along the boundaries of the specimens. The test results suggest an approximately elliptical interaction relationship. For the development of a simplified theoretical failure criterion, the assumption that transverse shear forces have a negligible effect upon the strength seems to be reasonable. Thus, the problem can be reduced to a state of plane stress. A three layer sandwich-model is proposed. The two outer layers are stressed biaxially and the inner layer is stressed only in the strong direction perpendicular to the bed joints. The most important assumptions and the main steps in the derivation of the failure criterion are shown. The tensile strength of the brick material has an important influence on this criterion within the range of relatively small axial loads perpendicular to the bed joints. The criterion is applicable to different masonry materials provided the required material properties are known. Reinforcement parallel and perpendicular to the bed joints can be considered. The strength of a laterally loaded wall can be calculated using the lower or upper bound theorem of the theory of plasticity.

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