

# **Minimum Horizontal Reinforcement Requirements for Seismic Design of Masonry Walls**

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## **Abstract:**

Rational limits are developed for the minimum amount of horizontal reinforcement in masonry shear walls exposed to seismic loads, and two criteria are formulated to avoid shear distress and premature failure upon diagonal cracking. A strength criterion requires horizontal reinforcement to resist the horizontal shear force transferred from the masonry upon diagonal cracking, while an energy criterion calls for sufficient toughness in horizontal reinforcement to absorb the elastic strain energy released by the masonry upon diagonal cracking. Verification with data from previous shear wall tests demonstrates that the reinforcement ratios given by these formulas are adequate for identifying walls with behavior dominated by shear distress, and which display low displacement ductility and energy dissipation factors. The strength criterion is seen to control minimum horizontal reinforcement requirements for walls reinforced with hot-rolled deformed bar, while the ranges of minimum reinforcement ratios dictated by both the strength and energy criteria are of comparable magnitude for walls with welded bed-joint reinforcement. Minor modifications to the material properties of these welded wire grids effectively eliminate the energy criterion, thus allowing a single formula to dictate minimum horizontal reinforcement requirements for walls with either type of reinforcement. The strength criterion is seen to require minimum horizontal reinforcement ratios on the order of 0.25% for walls with large masonry compression strengths and under high axial compression stresses. A simplified version of this formula is proposed for use in code provisions for seismic design of masonry shear walls.

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