Out-Of-Plane Shear Strength of Reinforced Concrete Walls and Slabs

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DOE facilities often have reinforced concrete shear walls and slabs that are thicker than conventional construction with relatively low amounts of flexural reinforcing. Walls below grade typically resist out-of-plane lateral soil loads. Above grade walls resist out-of-plane wind and tornado loads. Additionally, some interior walls also resist out-of-plane hydrostatic loads. Floor and roof slabs resist vertical dead and operating loads. All of these out-of-plane loads generate out-of-plane shear and each load has a corresponding seismic contribution. Current design practice is to resist out-of-plane shear loads by the concrete strength of the wall or slab alone.

A review of experimental test results for one-way out-of-plane shear without shear stirrups is presented. This review suggests that the anticipated performance goals of DOE-STD-1020 and ASCE 43 may not be met for certain wall and slab configurations that are present in the DOE complex. Potential mechanisms contributing to this performance deficit will be discussed along with the applicable design code capacities. An proposed empirical correction factor that meets the DOE-STD-1020 and ASCE 43 performance goals will be presented. A path forward for updating codes and standards will also be discussed.