

Retaining Wall Design Calculation (“RETWALL”)

Description: RETWALL (meaning "Retaining Wall") designs a reinforced concrete cantilever retaining wall. Footings can be either spread or pile footings (maximum of 4 pile rows). Backfill can be either level, with surcharge, or sloped. Arbitrary horizontal and vertical loads can be applied to the top for such situations as parapets, crash loads, noise walls, signs and lighting loads.

Theory: Rankine soil pressure theory is used. Only active unsaturated pressure is considered. Forces and moments of all vertical and horizontal loads are taken about the footing toe, then moments are resolved to the center of the footing, in the case of a spread footing, or the centroid of the pile group. The effect of surcharge vertical force is not included for overall stability computations but is included for heel design computations.

The choice of what load factors to use for footing design is the main difficulty and is somewhat controversial as to how to design the heel reinforcement. At the present time there are diverse opinions on how to design the heel, largely due to problems created by a load factor approach. Such questions as whether or not to apply the upward pressure under the footing to the heel design; whether to use a 1.4 (or AASHTO's 1.3) load factor to the earth dead load or use a 1.7 load factor to the earth dead load. For heel design, the program applies the upward pressure under the footing. It will apply a default load factor of 1.7 to all forces on the heel, unless the designer selects another value. In the authors opinion, any load factor less than 1.7 will be unconservative. Consider this: If the main load on the heel is dead load, and a load factor of 1.3 is applied to that load, isn't there only a 30% factor of safety? Using that reasoning, a 1.7 factor used for all components seems more appropriate. The designer is alerted to modify the heel design if the applicable design code requires different methods.

For sloping backfills, there is a vertical component, "Pv", which acts at a plane at the back of the footing. A partial component of Pv is applied to the back of the footing for heel design.

For spread footings, sliding must be checked. The designer should refer to 1991 AASHTO Interim Table 5.5.5B for typical values for friction factors and adhesion. This is an important aspect of the design, as sliding is a frequent cause of retaining wall failures.