~~   ???? ??, 2001~~

All Employees   521.1

Gary Novey

Bridges and Structures

Substructure Design-MM No. 3 (Punching Shear and Wide Beam Shear).

There have been some discussions on the design procedures for checking the punching shear and wide beam shear in T-pier footings. The concern involved what should be used for pile loads and allowable concrete stresses. These issues have become more of a problem because of the longer prestressed beams that the office is using and the resulting heavier loads. Designers have had some problems with excessive footing depths (> 5 ft.).

To help clarify the design, the following procedure should be used.

When designing for punching shear:

1. Base the shear stress for punching shear on the maximum pile load P/N (where P is the total load and N the number of piles) with bending moments ignored. Be sure to include any allowable overstresses for Group loadings.
2. Use section 8.15.5.6.3 ($v_c = (0.8 + 2/\beta_c)*f'c^{1/2} \leq 1.8*f'c^{1/2}$) of the AASHTO Bridge Specifications for calculating the allowable concrete stresses for punching shear.

When designing for wide beam shear the footing shear stress (v_c) shall be based on the pile design bearing capacity, not the maximum pile load.

The office would like to limit the footing depth to 5 ft. or less, because of the problems heat of hydration can cause in larger concrete sections. Surface cracks can develop due to the temperature differential between the center of the concrete section and the exterior surfaces. Because of the possibility for cracking, special placement may be required for these deeper footings.

If situations develop where the footing depth is excessive (>5ft), check with your section leader for approval.