

## MARCH 9 2011 MEETING

Wednesday, March 9, 2011 (1.0 PDH)

### TECHNICAL PROGRAM

#### WaffleMat Slab-on-ground Forming System

**Speaker:** Kenneth L. Douglass, P.E., MBA, Four D Engineering, Inc., Spring, TX, Tel. No. (281) 808-7071

Kenneth L. Douglass is currently a Professional Engineer Consultant with Four D Engineering, Inc. in Houston, TX. He has earned his Bachelor of Science from the Colorado School of Mines in 1974 and MBA from the University of Houston in 1983. He has 15 years of experience in the post-tensioning industry designing slab-on-ground foundations in Texas, California, and Nevada. He is an active voting member of the Post-Tensioning Institute Slab-on-Ground Committee, Structural SOG Sub-Committee, SOG Construction & Maintenance Subcommittee and Chairperson of the SOG Education & Communication Subcommittee.

### PRESENTATION SUMMARY

To an audience of about 65 at the HESS Club, Mr. Douglass gave a slide presentation titled, "Wafflemat Slab-on-ground Forming Systems". Mr. Douglass described the system as an innovative and proven foundation forming system for slab-on-ground foundations constructed on low and moderately expansive soils. The patented system was developed for Northern California to stop lawsuits over water intrusion through uniform depth slabs used in that area. To date the system has not been used in Texas.

Mr. Douglas noted that the Wafflemat system may be implemented using either conventional reinforcing or post-tension reinforcing and that it boasts over 6.5 million sq. ft. of residential living space placed since 1995 without one structural callback. He stated that the Wafflemat System has the advantages, efficiency and stiffness of a ribbed slab type foundation system with sufficient strength to resist differential swell of moderately expansive soils.

The Wafflemat comes in 8½" or 12" high, 19¼" x 19¼" thermal-grade heat resistant waffle boxes. The waffle boxes, which are stackable for shipping, are constructed of reprocessed polypropylene, are open at the bottom, and are strong enough to support the weight of construction crews. The boxes hold up to a 6" monolithically poured post-tensioned or conventionally reinforced concrete slab. The interior stiffening beam widths taper from 6" at the ground to 8" wide at the bottom of the slab. The perimeter beams are typically 12" wide or as needed. The Wafflemat sits on the ground like a raft, and the voids created by the waffle boxes allow for expansive soil movement.

The Wafflemat System is created by connecting the boxes in an evenly spaced grid layout, like a pan joist system. The monolithic pour creates concrete stiffening beams running through the footprint and perimeter. The system can be installed easily by a local concrete provider and offers building cycle time reduction and cost savings by eliminating trenching time, moisture barrier installation, pad presoaking, and reinforcing supports. Variable height, fold-out tendon supports are included in the original molding process so there are no loose pieces to install.



There is less need for a moisture retarder in this system given the void space present below the slab. However, if one is used, the moisture retarder should be installed below the stiffening beams. By design, the slab tendons will be spaced at 3'-8" or 3'-10" to be centered over the stiffening beams. If more slab tendons are needed in the design, these tendons are simply doubled up. Beam tendons, if needed, are located directly below the slab tendons. To satisfy the PTI requirements, the designer uses a 6 ft. spacing for the beam stiffener spacing for the strength calculations. However, PTI allows the designer to use the actual beam spacing in the stiffness calculations.

Some other points made by Mr. Douglass included:

- The beams are poured first and then the slab is poured
- Because all tendons are in the beams, workers do not walk on the tendons during the pour.
- There is no interior beam water to pump out during slab makeup after a rain.
- Less concrete is needed because of the closer dimensional tolerances achieved over conventional excavated stiffening beams
- Normally the concrete can be poured in 30% less time for this system.
- Though the interior stiffening beam depths are fixed, the perimeter beams can be cut into the soil as deep as needed to act as a moisture or root barrier.
- For plumbing, the horizontal runs are below the bottom of the beams and the vertical protrusions are achieved by removing an entire box.
- Though the purchase cost of the waffle boxes is about \$1.70/SF, overall savings can be achieved with less labor, less concrete, and less construction time.

In conclusion, the Wafflemat System may not be suitable for poor-bearing or highly expansive soils or the variable depth applications of sloping sites. The system appears to work well on low to moderately expansive soils. In the appropriate application the Wafflemat System appears to provide a strong stiff and cost-effective method of installing a reinforced concrete slab on grade.

For a copy of Mr. Douglass's slide presentation, click [here](#).

**[PAST PRESENTATIONS \(click here\)](#)**