

## MAY 2012 MEETING

Wednesday, May 9, 2012 (1.0 PDH)

### TECHNICAL PROGRAM

#### Geoforensic Investigation of Distressed Inground Swimming Pools in the Houston Area

**Speaker:** Ray Mojarrad, Ph.D., Project Manager, Geotech Engineering and Testing 800 Victoria Drive Houston, Texas 77022, Tel. No. 713-699-4000

Ray Mojarrad is a Project Manager at Geotech Engineering and Testing (GET) where he provides geotechnical and geoforensic engineering services. His responsibilities consist of evaluating the distress causation(s) and developing recommendations on repair techniques for residential and commercial buildings, swimming pools and petrochemical structures. He has also provided foundation recommendations for residential, commercial, industrial, and petrochemical structures. Mr. Mojarrad has an extensive background in pavement design, he has provided flexible and rigid pavement recommendations for commercial, industrial and airport projects subjected to high traffic loading. Mr. Mojarrad has B.S., M.S. and Ph.D. in civil engineering specializing in geotechnical engineering. His Master thesis is about evaluation of shear wave velocity on clay core of rockfill dams. He received his Ph.D. degree in civil engineering from North Carolina State University (NCSU). His Ph.D. dissertation consisted of studying different parameters affecting airport flexible pavement design, using Nonlinear 3D Finite Element Modeling.

### PRESENTATION SUMMARY

To an audience of about 65 at the HESS Club, Dr. Mojarrad presented a number of case studies of inground swimming pool structures and failures. The relationship between soils, design, materials, construction and maintenance were discussed. It was noted that the soils testing and design for inground swimming pools is not the same as that for slab on grade structures. Soil testing for swimming pools typically requires deeper borings. Swimming pools are also commonly affected by plumbing leaks and landscaping. Swimming pools may have varying depths and the overburden for pools is different than for slabs on grade since both wet and dry (empty and full) pool conditions must be considered. Soil moisture content also plays a large role in the success of the pool installation and long term structural integrity.



Addressing pool failures, Dr. Mojarrad discussed a number of methods used to trace and determine the source of failures. A history of the failure is often important when determining the cause or source of the failure. A dry pool in combination with saturated soils induces a strong upward soil pressure which may cause the pool to lift out of the ground. Soil testing around the failed pool is essential to determine if the design and installation are adequate. When ground water is present, the water itself may be tested to determine its origin. Tap water (plumbing leaks), pool water, rainwater and ground water all have different properties. Testing may isolate the source of water.

Ground penetrating radar (GPR) may be employed to verify as-built conditions of the structure and to locate underground utilities. Landscaping may play a major role in the health of the pool. Trees may desiccate the soil causing subsidence and loss of soil support and may lead to an uneven pool water level. Offsite trees have been shown to seek out neighboring pools that have minor leaks exacerbating the problem.

In conclusion, Dr. Mojarrad pointed out that a successful swimming pool installation requires adequate testing, proper design, good construction practice and proper maintenance.