Drilling Foundation Shafts? Control Fluid Loss

One of the big issues when using a synthetic slurry for foundation drilled shafts is losing slurry through coarse, unconsolidated formations. If the level of the slurry drops below the required level to maintain adequate hydrostatic head pressure, the shaft can collapse. If drilling is completed too late in the day to pour concrete, contractors often have one either stay the night on the jobsite or make frequent trips to the jobsite throughout the night so that they can top off the shaft to maintain adequate hydrostatic head pressure.

Many contractors resort to conventional bentonite slurry when certain soil conditions, such as gravel and cobble, are noted on bore logs. These situations necessitate the use of drilling fluid recycling/cleaning equipment. CETCO recently developed a fluid-loss additive that can dramatically reduce and even eliminate the loss of synthetic slurry in a foundation drilled shaft when drilling through coarse, unconsolidated soil conditions. This product can broaden the range of soil conditions that can be drilled with synthetic slurry.

**THE ULTRA-HIGH VISCOSITY (75 TO 110 SECOND FUNNEL VISCOSITY) OF SYNTHETIC SLURRY SLOWS THE MOVEMENT OF WATER THROUGH THE FORMATION AS OPPOSED TO WATER, WHICH IS 26 SECONDS ON A FUNNEL VISCOSITY.**

Two things have to occur for a drilling fluid or slurry to maintain borehole stability. First, a barrier must be placed between the drilling fluid or slurry and the formation. This barrier is also referred to as the filter cake or polymer gel membrane. This is accomplished by hydrostatic head pressure when the hole is kept full of slurry. Mineral slurry (i.e., bentonite drilling fluid) accomplishes this by the layering of overlapping platelets from Wyoming sodium bentonite. This barrier is also referred to as the filter cake. A synthetic (i.e., polymer) slurry accomplishes this by utilizing a long chain/high molecular weight polymer to plug pores and form a polymer gel membrane instead of a filter cake. The ultra-high viscosity (75 to 110 second funnel viscosity) of synthetic slurry slows the movement of water through the formation, as opposed to water, which is 26 seconds on a funnel viscosity.

In foundation drilled shafts utilizing synthetic slurry, it is important to maintain a minimum of 6 feet of hydrostatic head pressure above the water table at all times. If the groundwater is influenced by tides, that must be factored in. Anytime this 6-foot minimum is not maintained, especially when drilling in unconsolidated formations such as gravel and cobbles. Recently, some new and exciting technologies have become available. One of these is Shore PAC X. This new admixture is a specially synthesized polymer nano-composite designed for use as a loss-circulation mitigation additive.

Shore PAC X does not adversely affect the bonding of concrete to rebar, does not reduce skin friction and is instantly broken down when it comes in contact with calcium in concrete at the time concrete is being poured. Malcolm Drilling was one of the first contractors to use Shore PAC X on several projects around the Los Angeles area where fluid loss was an issue. “Upon application of Shore PAC X, fluid loss was mitigated and the slurry loss to the formation was under control,” Mike Hagy of PACO Ventures tells me.

In another successful trial, Anderson Drilling tried out Shore PAC X on a project in Butte, Mont., installing cast-in-drilled-hole (CIDH) piles for a bridge over Silverbow Creek. “There were 10 shafts, 9 feet in diameter by 43 feet deep,” Hagy says. “The soil conditions consisted of silty and clayey sand, sand, gravel, cobbles and some boulders. Static water was anywhere from 8 feet to 40 feet. A Shore PAC slurry was mixed with a viscosity of around 110 seconds per quart due to the anticipated porosity of some of the lenses. Upon reaching some of the more porous lenses, high fluid loss to the formation began to occur. To combat this, Shore PAC X was added to the slurry in the tank. It blended and mixed well with the Shore PAC polymer and fluid loss to the formation was kept to a minimum.”

As previously mentioned, maintaining adequate hydrostatic head pressure in order to apply positive pressure against a polymer gel membrane is the key to maintaining borehole stability when using synthetic slurry in foundation drilled shafts. Having the ability to control the loss of fluid through porous formations is essential, and new products that can effectively perform this task are essential when drilling in extreme soil conditions.