Horror Stories and Testing Error with In-Situ Testing

Any testing error unnecessarily adds variability to the characterization of the soil or rock properties. As a result, the design engineer will provide an overly conservative and costly design for variability that is not within the soil or rock at the site.

<u>Pressuremeter Test:</u> I performed pressuremeter tests for the preliminary design of the Washington DC subway line to Dulles Airport. A second firm performed pressuremeter tests for the final design of that alignment. I received a call from the designer and was asked why are the modulus values from my tests four (4) times more than those from the second firm. I asked the designer, “How did the second firm make the borehole for those tests?” He told me, “They drove an over-sized split barrel spoon.” I told him, “That method is not one of the several different methods that ASTM recommends and that the soil was remolded by the spoon.” He asked me, “How I made my test holes?” I told him, “I used mud rotary methods and carefully monitored the flow rate, rotation rate and penetration rate.” He called me back about one month later and told me, “I had the second firm go back and perform pressuremeter tests next to one of my holes making the borehole with mud rotary methods. The results were very similar to my results!”

<u>Cone Penetrometer Test:</u> The CPT technician continued to push a cone with a tip that was smaller than specified by ASTM and much smaller than the friction sleeve. In addition to the friction resistance, the sleeve friction measurements included a parasitic end bearing force where the friction sleeve extended beyond the undersized tip. As a result of the artificially high friction ratios, the soil behavior type classified sands as clays. A π tape should be used to accurately measure the diameters of the tip and sleeve to make sure that they satisfy ASTM requirements.

To measure pore pressures with a piezocone, the pore pressure transducer must be fully saturated. Unfortunately, technicians often do not use saturated filters and pore pressure measurements are sluggish and inaccurate. Pre-saturated filters from the laboratory can eliminate air bubbles. A properly saturated filter where the fluid expels all air bubbles is shown on the right.

Unfortunately, many firms present the pore water pressure in units of psi, tsf, psf, or kPa instead of either feet or meters of head. In cohesionless soil with pressure units of head, the pore water pressure is hydrostatic and where this line of pore pressure intersects zero is the depth of groundwater.

<u>Dilatometer Test:</u> The DMT pressures must be measured to the nearest 1 kPa when pressures are less than 10 bars. Because the gradation marks on the DMT control unit low pressure gauge are at 5 kPa intervals, technicians often record DMT pressures to the nearest 5kPa. The engineer can easily determine when the readings are inaccurate because all the readings will end with either a 0 or 5. Technicians often inflate the membrane too quickly and the pressure in the blade is not the same as the pressure on the gauges in the control unit. In very soft clays, often critical for geotechnical design, the dilatometer “A” and “B” pressure readings are only slightly more than the membrane calibration “ΔA” and “ΔB” pressures. On multiple occasions, I have reviewed data collected by others where the constrained deformation modulus could not be calculated. In these cases, the difference between the “B” and “A” readings was less than the difference between the “ΔB” and “ΔA” calibration pressures. In each case, I recommended the dilatometer tests be redone and measurements be carefully made.