In-situ geotechnical testing can provide more geotechnical properties than the Standard Penetration Test. When more detailed information about the strength and compressibility of soil and bedrock is required beyond just the “blow counts,” in-situ methods should be considered. These include the field vane shear test, borehole pressuremeter and dilatometer, the borehole shear test, and the cone penetration test.

**Field Vane Shear Test**

The vane shear test is used to evaluate the in-situ undrained shear strength of fine-grained soils, such as soft clays, silts, organic clay, and mine tailings. The undrained shear strength is an important soil parameter that is critical for calculation of soil bearing capacity and foundation stability. The test follows ASTM designation D2573-08 “Standard Test Method for Field Vane Shear Test in Cohesive Soil,” and is not applicable in sands, gravels, or bedrock.

The test is usually performed at the bottom of a borehole, in which a rod with four thin radial blades (vanes) at the end is inserted into the soil. The resistance to rotation of the rod is determined by measuring an applied torque at the ground surface and converting it to a shearing resistance of the soil. The diameter of the blades varies and is usually 1.5 inches to four inches; its height is usually twice the overall width. The larger blades are used in softer soils; smaller blades are used in stiffer soils. The torque is either applied to the vane with a gear box or it can be applied manually, with the former usually performed during the initial geotechnical exploration and the latter generally performed as part of construction verification testing.

**Borehole Pressuremeter**

The borehole pressuremeter is a device used to assess the in-situ stress-strain response of soil and weak or fractured bedrock. The test is governed by ASTM designation D4719-07 “Standard Test Method for Prebored Pressuremeter Testing in
offices in North Dakota. Our staff in Dickinson and Williston are working six very long days to serve our clients under adverse conditions of virtually no housing and/or infrastructure. I am thankful for having “can-do” employee-owners at all of our 23 locations.

I have always been a firm believer that difficult economic times create stronger individual and corporate character and forces each of us to grow personally for the success of our organization. American will continue to reach out to our clients and business associates to establish trusting relationships and strong partnerships, which contribute to our client’s success. As an organization, American is excited about implementing our planned strategies for new and expanded expertise, services and offices in 2012.

Given the tough economy, American is implementing its plans to make the ride exciting, more profitable and most importantly, meet the requirements of our clients. We understand the exodus from this economic malaise is predicted to be slow, but American is excited about laying the foundation toward future prosperity from the opportunities presented to us now.

American wants to be your business partner and serve as a resource to you. With 2012 just around the corner, we look forward to contributing to your success in the next year and in the future.

Wishing you the happiest of holidays—Terry.
The borehole shear test is sometimes referred to as the “Iowa Borehole Shear Test,” because it was originally developed by Dr. R.L. Handy at Iowa State University. The borehole shear test is a rapid and simple test that is similar to performing a laboratory direct shear test, except on the side-walls of a borehole. The borehole shear test is primarily intended to test fine-grained cohesive soils, such as clays and silts. In this test, a shear head consisting of two steel plates is lowered into a predrilled borehole to the depth that shear strength information is required. The shear head is opened with gas pressure so that the plates press laterally against the soil. After a 15 minute wait, the shear head is pulled upward, and the shearing load is measured. The same procedure is then repeated with progressively higher opening pressures. A Mohr-Coulomb plot can then be generated to calculate a shear strength and friction angle for the soil tested. The test is useful for obtaining geotechnical parameters needed for slope stability analyses and landslide studies.

The borehole shear test can not only be used in soil, but can also be used for the in-situ measurement of the cohesion and friction angle of bedrock. The test is particularly advantageous in rock formations that are too weak or fractured to core, such as clay shale, sandstone, and weathered granite.

**Conclusion**

These are only some of the tools available that help to better define the strength and compressibility of subsurface soils and bedrock. The better the geotechnical properties at a site can be evaluated, the more optimized the geotechnical solutions can become, which lowers the risk for problems related to the subsurface conditions.

Next issue: The Cone Penetration Test

About the author: Gregory Reuter, PE, PG is a principal geotechnical engineer and engineering geologist for AET and works at the St. Paul office. If you have any questions, he can be contacted at greuter@amengtest.com.

AET was retained by Bruckelmyer Brothers Construction to perform special inspections and construction materials testing. AET also performed special inspection during pile installation. Specializing in pile foundations and earth retention systems, L.H. Bolduc provided piling services. The lodge is scheduled to be completed for the 2012/13 season.

It’s not every day that you see a large pile-driving crane atop a hill. Although one would expect this topographic high to be bedrock, Mont Du Lac ski hill in Superior, WI is comprised of glacial lake sediments. These soft clayey soils required a pile-driven foundation to support the new Mont Du Lac Mountain Recreation Lodge.
AET UPDATES

Ross O’Connor – CMT I / St. Paul – Welcome back!
Christopher Braaten – Petrographer/Geologist – transfer from AET St. Paul to APS St. Paul
Travis Drier – CMT II / St. Paul

Certifications
Charlie Tiller – LEED AP BD&C

Upcoming Speaking Engagements
Dave Rettner – Jan.12 – CEAM Concurrent Session Planning
Bill Kwasny – Jan. 25 – World of Concrete, Las Vegas, NV
Tom Venema – Feb. 15 – Structural Engineers Conference
Rob Flickinger and Jeff Voyen – Mar. 15 – APWA Underground Utilities Inspection School

Promotions
Robert Wahlstrom, PE, PG was recently promoted to Principal Environmental Engineer. Rob works out of AET’s St. Paul, MN office serving clients with his geotechnical and environmental expertise for brownfield and greenfield developments.

Gregory Owens, PG, CWI was recently promoted to manager of AET’s East Region. Greg works out of AET’s Wausau, WI office and will now also oversee AET’s Chippewa Falls, WI, Green Bay, WI and Duluth, MN operations.

Eric Edlund was recently promoted to manager of AET’s Duluth office. Eric will work closely with Greg Owens to expand the Duluth operation and continue to serve AET’s northern Minnesota and northwestern Wisconsin clients.

Employee Spotlight – Steve Ruesink
Steve Ruesink, PE joined AET in the summer of 2011 as a principal engineer and regional manager for AET’s southern Minnesota offices of Mankato, Rochester and Marshall. Steve has 30 years of geotechnical engineering, construction materials testing and inspection experience. He has worked with commercial, state, federal and municipal government clients on numerous projects.

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