Application of Automated Laboratory Tests to Minnesota D.O.T. Highway Project Site Characterization

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Abstract

In 1997 the Minnesota Department of Transportation (Mn/DOT) began operating fully automated computer controlled geotechnical testing equipment, replacing many existing systems. Existing systems required active technician oversight particularly for consolidation and triaxial testing. An increase in the number of projects requiring testing, shorter project time-lines, rapid advances in computer technologies, a decrease in the number of skilled technicians, and a desire to reduce project costs, made automated systems especially attractive. As a result of the effectiveness of the automated systems, today, the geotechnical section routinely conducts specialized tests previously available only to academic institutions and research labs. Automated laboratory testing combined with automated in-situ cone penetration testing (CPT) has dramatically improved overall site characterization quality while reducing both cost and time associated with geotechnical investigation. Test reliability, repeatability, accuracy, and confidence in the test results has improved, while decreasing subjectivity and operator error. Measurable cost savings, both in field costs and lab costs, and increases in efficiency have been realized, even after the relatively large investment cost of the new equipment.

A comprehensive suite of lab and in-situ CPT tests were performed on clay soils at a bridge site in northern Minnesota; results of this study are presented to illustrate the uses and benefits of automated systems. Lab tests included 1-D consolidation, triaxial stress path, flexible wall constant gradient permeameter tests, direct shear, and direct simple shear tests. Shear strength (s_u) and modulus values (M, G, E) were compared with in-situ CPT tests conducted at the site.