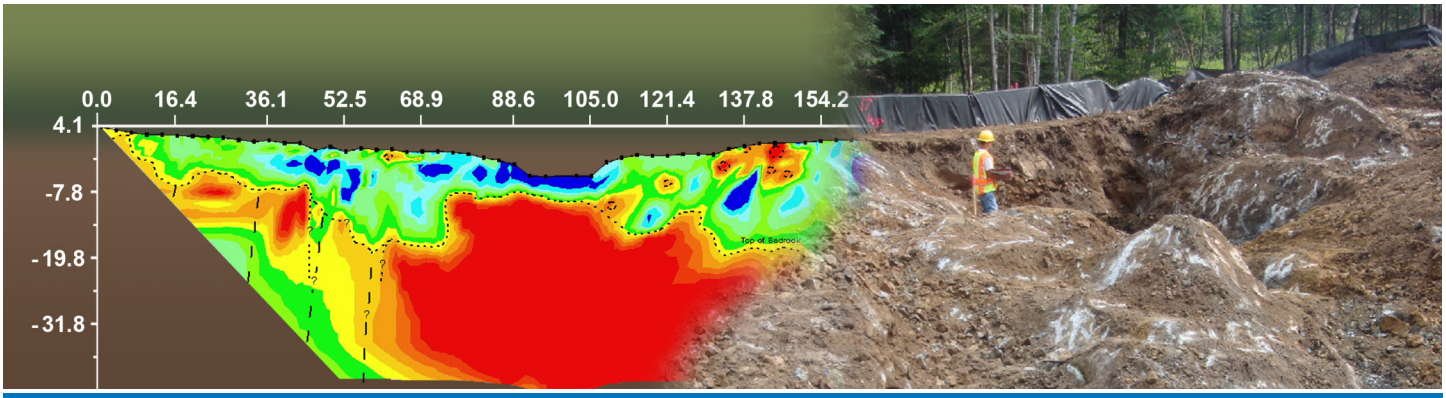
Advanced Geotechnical Methods in Exploration (A-GaME)

Mitigate risks and improve reliability by optimizing geotechnical site characterization with proven, effective exploration methods and practices.



Geophysical profile showing variability in bedrock surface, confirmed during excavation.

Up to 50 percent of major infrastructure projects suffer impacts to schedule or cost due to geotechnical issues. Many of these issues relate to risks identified directly or indirectly to the scope and quality of site characterization work. Effective site characterization is critical for recognizing potential problems that may affect design and construction and for ensuring safe, well-performing, and cost-effective projects.

IMPROVED GEOTECHNICAL SITE CHARACTERIZATION

Current practice for characterizing a project site will typically include a minimum number of borings with samples obtained every few feet. Drilling and sampling at discrete locations requires engineers to construct profiles of the subsurface using interpolation, which may result in uncertainty in design and construction.

Differing site conditions, due to inherent variability in top of rock elevation, groundwater levels, and stratigraphy location and thickness, represent a significant number of cost escalations and delays on highway and bridge construction projects. These problems arise when the site conditions encountered differ from those documented in geotechnical reports and contract documents developed from prescriptive and minimal subsurface exploration programs. Making decisions with incomplete or limited information can result in costly constructability issues and claims.

Several proven, effective, and underutilized technologies are available that, when combined with processes that assess risk and variability, allow optimization of subsurface exploration programs for improved site characterization and maximum return-on-investment. These technologies include cone penetration testing, seismic and electrical geophysics, measurement while drilling, and optical and acoustic televiewers.

BENEFITS

- **Reduced Risk.** Reducing uncertainties in subsurface conditions mitigates design and construction risks.
- **Improved Quality.** Improving confidence in the geotechnical characterization reduces unnecessary conservatism in design and establishes a more reliable basis for design and construction of foundations and other geotechnical features impacting the highway system.
- **Accelerated Project Delivery.** Since a significant number of construction delays can be attributed to inadequate knowledge of subsurface site conditions, well-scoped investigation programs improve decision-making and constructability, providing time and cost savings for transportation agencies.

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Groundwater conditions missed during geotechnical exploration are a frequent source of problems.

STATE OF THE PRACTICE

In 2016, the National Cooperative Highway Research Program issued *Synthesis 484: Influence of Geotechnical Investigation and Subsurface Conditions on Claims, Change Orders, and Overruns*. The synthesis reported that modest, targeted changes to subsurface investigation practices can produce significant reductions in claims, change orders, and overruns and found that establishing standards for subsurface investigation and site characterization can result in more accurate plan quantities, better prepared contractors, and improved design efficiencies. State departments of transportation (DOTs) interviewed included Florida, South Carolina, and Minnesota:

- Florida DOT implemented targeted subsurface investigation practices to address specific subsurface claim, change order, and cost overrun issues.
- South Carolina DOT established standard subsurface investigation and site characterization guidelines to help contractors prepare for the subsurface materials they will encounter at the project site.
- Minnesota DOT regularly uses CPT soundings for all applications to increase the density of subsurface investigation locations and information with depth.

RESOURCES

FHWA EDC-5 Advanced Geotechnical Exploration Methods
https://www.fhwa.dot.gov/innovation/everydaycounts/edc_5/geotech_methods.cfm

NCHRP Synthesis 484: *Influence of Geotechnical Investigation and Subsurface Conditions on Claims, Change Orders, and Overruns*
http://www.trb.org/Publications/Blurbs/173907.aspx

Track-mounted cone penetration testing (CPT) rig preparing to investigate embankment failure.

U.S. Department of Transportation
Federal Highway Administration

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